PHYSICS ABSTRACTS

SECTION A

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

Edited and Issued Monthly by

THE INSTITUTION OF ELECTRICAL ENGINEERS

In Association with

THE PHYSICAL SOCIETY

THE AMERICAN PHYSICAL SOCIETY

THE AMERICAN
INSTITUTE OF ELECTRICAL ENGINEERS

ABSTRACTS 3398–3765

VOLUME 50 **DECEMBER 1947** NUMBER 600

AND

ANNUAL INDEX

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Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page 3 of cover*]

MATHEMATICS 51

31 3398

pplication of quaternions to rotations in hyperbolic e of four dimensions. CONWAY, A. W. *Proc. Soc. A*, **191**, 137–45 (*Nov.* 11, 1947).—In flat ace a general rotation can be made up of two ar rotations in orthogonal planes, and these com- nt rotations are commutative. In hyperbolic space neral rotation is made up of two planar rotations in es which are reciprocal with respect to the hyper- e, $t^2 = x^2 + y^2 + z^2$. Of the two planes one cuts hypercone in real 4-vectors and the rotation in this e is hyperbolic, the rotation in the other plane is ular. The rotations are commutative. A second type ransformation which has some of the properties of a tion is also considered. A.

.2 : 519.53 3399

Corrigenda: A general form of the covering principle relative differentiation of additive functions. II. ICOVITCH, A. S. *Proc. Camb. Phil. Soc.*, **43** (*Pt* 4) (1947).—[See Abstr. 941 (1946)].

.561.3 3400

A series for the stationary value of a function. SMITH, T. *c. Phys. Soc., Lond.*, **59**, 323–6 (*March*, 1947).— ormula is given for the stationary value of a function any number of variables in terms of the values of the ction and its differential coefficients at any point in the ghbourhood of the stationary position. A.

3.5 : 621.317.39 = 82 3401

Application of the electrical integrator for conformal nsformations of single boundary areas. TOLSTOV, Y. G. *ll. Acad. Sci. URSS, Dep. Tech. Sci.* (*No.* 2) 159–64 47) *In Russian.*—[Abstr. 3034 B (1947)].

8.5 : 621.317.39 : 548.73 *see Abstr.* 3725

8.5 : 621.317.733 3402

Bridge type electrical computers. ERGEN, W. K. *Rev. Sci. Instrum.*, **18**, 564–6 (*Aug.*, 1947).—[Abstr. 3052 B (1947)].

518.5 : 621.318.572 3403

Electronic computing circuits of the ENIAC. BURKS, A. W. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **35**, 756–67 (*Aug.*, 1947).—[Abstr. 3074 B (1947)].

518.6 3404

A least-square application to relaxation methods. BOWIE, O. L. *J. Appl. Phys.*, **18**, 830–3 (*Sept.*, 1947).—A least-square application to relaxation techniques is presented wherein the mean-square error is minimized in considering any corrections to a given set of values for the unknown function. A systematic procedure is, therefore, devised for weighting errors at various points of the lattice. The process has general applicability to various forms of equations and definitions of corresponding difference equations. As illustrations, Laplace's and the biharmonic equations are considered. A.

519.2 : 539.11 3405

Statistical properties of networks of flexible chains. JAMES, H. M. *J. Chem. Phys.*, **15**, 651–68 (*Sept.*, 1947).—A Gaussian network is defined as a network of flexible chain segments, linked to each other and to a system of fixed points, in which each unbranching chain segment can take on a number of configurations which is a Gaussian function of the distance between its ends. Real molecular networks, such as those of rubber, can under certain circumstances be treated as Gaussian networks. The paper carries out a systematic mathematical discussion: the total number of possible configurations of the network as a function of the fixed-point co-ordinates, the probability of finding a given element of the network in a given position, or of finding two elements of the network in given relative positions, etc. A.

519.4 : 536.7 *see Abstr.* 3525

519.53 : 517.2 *see Abstr.* 3399

ASTRONOMY . ASTROPHYSICS . GEODESY 52

1.042 : 539.155.2 *see Abstr.* 3610

1.042 : 539.155.2 = 4 3406

The influence of the temperature on the relative undances of the elements. DEMEUR, M. *Physica, 's rav.*, **13**, 321–5 (*Aug.*, 1947) *In French.*—Chandrasekhar nd Henrich [Abstr. 1739 (1942)] suggest that their theory ould account for the abundance of heavy elements if ey were formed at an earlier stage of evolution than the ghter elements. This is not so, as the temps. required re high enough to demand consideration of other hysical conditions neglected in their theory. G. J. K.

21.042 : 539.155.2 = 4 3407

On the relative abundances of the elements. GÉHÉNIAU, , PRIGOGINE, I., AND DEMEUR, M. *Physica, 's Grav.*, **13**, 29–32 (*Aug.*, 1947) *In French.*—The theory of Chan- rasekhar and Henrich agrees much better with observa- on for the heavy elements if allowance is made in the tatistical weights not only for nuclear spin but for the nternal structure of the nucleus. G. J. K.

523.31 3408

The magnetic field of the moon? CHAPMAN, S. *Nature, Lond.*, **160**, 395 (*Sept.* 20, 1947).—On the basis of Blackett's formula [Abstr. 1715 (1947)] the surface field t the pole would be expected to be 0·001 gauss. The possibility of confirming this figure by direct measurement with rockets is briefly discussed.

523.51 : 537.591.8 3409

Production of helium in meteorites by cosmic radiation. BAUER, C. A. *Phys. Rev.*, **72**, 354–5 (*Aug.* 15, 1947).—To explain the relatively large amount of He in small meteorites it is suggested that some has been produced by cosmic radiation. If then the larger meteorites maintain their high velocity for a longer time much of the outer layer will evaporate leaving the inner part which has been more effectively shielded from the influence of cosmic rays. Such a shielding would not obtain in the meteorites of smaller mass. W. E. D.

523.51 : 539.155.2 *see Abstr.* 3611–12

523.72 3410

Relative times of arrival of bursts of solar noise on different radio frequencies. PAYNE-SCOTT, R., YABSLEY, D. E., AND BOLTON, J. G. *Nature, Lond.*, **160**, 256–7 (*Aug.* 23, 1947).—Observations were made simultaneously at 200, 75 and 60 Mc/s with a few observations at 30 Mc/s. Most of the bursts, particularly the smaller ones, were not correlated on the various frequencies; of those that were, the majority were observed first on the higher frequency, with a delay of approx. 2 secs between

the frequency bands. Occasionally much longer delays were observed, e.g. the large burst on March 8, 1947, when the 200/100 and 100/60 Mc/s delays were 2 min and 4 min resp. It is suggested that bursts of a given frequency originate at a particular level in the corona and are caused by a physical agency travelling through the successive levels at 500–750 km/sec.

523.72 : 523.752 *see Abstr.* 3413

523.72 : 523.854 : 551.594.6 3411

Solar and terrestrial radio disturbances. HEY, J. S., PARSONS, S. J., AND PHILLIPS, J. W. *Nature, Lond.*, **160**, 371–2 (*Sept.* 13, 1947).—There is an unexpectedly high 12-m wavelength radiation from the galaxy, and this can be used to detect increases in *D*-layer ionization, which will cause absorption at this wavelength. This is only possible when solar bursts are absent, or before they arrive; and two examples are given of a drop in galactic radiation coinciding with a radio fade-out, with, in the second case only, a solar burst occurring 4 min later. A possible explanation is advanced.

523.746 3412

The great sunspot group of March and April, 1947. HOGE, E. R. *Publ. Astr. Soc. Pacif.*, **59**, 109–11 (*June*, 1947).—This was the second largest group ever photographed. First observed February 5, 1947, as some small spots. Reappeared at *E* limb on March 3rd, its max. area during this transit being 4 300 millionths of a solar hemisphere. Made two further transits before it disappeared on the *W* limb on May 11th. Failed to make fifth appearance. The max. magnetic field measured was 3 800 gauss. No major geomagnetic storms were associated with this group—only a few minor storms. Plates are given showing the morphology of the spot during its second and third transit and of lines indicating the general distribution of magnetic polarities. V. C. A. F.

523.752 : 523.72 34

A short-lived solar phenomenon in high latitu THACKERAY, A. D. *Nature, Lond.*, **160**, 439–40 (*Sept.* 2 1947).—Intensely dark absorption flocculi were observ on the morning of June 19, 1947, near the south point the sun, and appeared to be due to a mass of gas movi into the sun with high velocity. Bursts of radio noise 175 Mc/s were observed, coinciding with the later stag of the phenomenon.

523.841 : 523.87 *see Abstr.* 3416

523.852 = 4 34

Study of the distribution of colour in the spiral nebu M51 (NGC 5 194–5) by the method of stereoscopic effe tive wavelengths. RÖSCH, J. *C.R. Acad. Sci., Paris*, 22 223–5 (*July* 28, 1947) *In French.*—Results (shown on colour chart) agree with coarse-grating measures Velghe for nebular condensations, but these are found differ in colour from the adjacent nebulosities. N systematic variations with position occur, but one out region is markedly red. D. L.

523.854 : 551.594.6 : 523.72 *see Abstr.* 3411

523.87 341

Absorption lines formed in a moving atmospher UNDERHILL, A. B. *Astrophys. J.*, **106**, 128–34 (*Jul* 1947).—Chandrasekhar's theory of radiative equilibriu is used in computing line profiles for a uniformly expan ing atmosphere. The results are a refinement of tho obtained by Wilson [Abstr. 4509 (1935)]. The effects differential motion are also discussed. R. A. B.

523.87 : 523.841 341

Spectrum of ρ Cassiopeiae. THACKERAY, A. D. *Natur Lond.*, **160**, 370–1 (*Sept.* 13, 1947).—The chief change noted in this complex spectrum since August 1946 a described.

525.66 : 551.461.2 *see Abstr.* 3731

PHYSICS 53

53.081.4 : 551.521.1.081.4 *see Abstr.* 3739

FUNDAMENTALS 530.1

530.12 : 530.145 3417

The vector meson field and projective relativity. HOFFMANN, B. *Phys. Rev.*, **72**, 458–65 (*Sept.* 15, 1947).—In the projective theory of relativity, if, instead of the projective metric $G_{\alpha\beta}$ of index $2N$, one uses the restricted metric $\gamma_{\alpha\beta}(\equiv G_{\alpha\beta}/G_{00})$ of index zero, one is led to a formal unification of the gravitational and electromagnetic fields of the general theory of relativity. The present paper discusses the case of the general metric $G_{\alpha\beta}$. It is shown that a natural 4-dimensional, gauge-invariant variational principle, involving the curvature scalar of $G_{\alpha\beta}$, yields field equations unifying the gravitational and vector meson fields, the range of the meson force being determined by the inverse length $(12)^{\frac{1}{2}}N$. Reasons are given for supposing that an extension to conformal geometry could prove of interest. A.

530.12 : 531.51 3418

A class of exact solutions of Einstein's field equations. DATTA MAJUMDAR, S. *Phys. Rev.*, **72**, 390–8 (*Sept.* 1, 1947).—The work of Weyl on the gravitational field occasioned by an axially symmetric distribution of matter and charge is generalized to the case in which g_{44} and ϕ for an electrostatic field are functionally related, with or without spatial symmetry. It is shown that the most general electrostatic field in which g_{44} and ϕ are related by an equation of the form $g_{44} = \frac{1}{2}(\phi + c)^2$ can be represented by a line element of the form $(ds)^2 = - e^{-w}[(dx^1)^2 + (dx^2)^2 + (dx^3)^2] + e^w(dt)^2$. Certain the field equations are then identically satisfied whil the remaining ones reduce to a single equation for w. The substitution $w = -2\log(1 + v)$ transforms thi into Laplace's equation for v, so that the solution can b expressed in terms of harmonic function. A.

530.12 : 537.1 341

On the Lorentz transformation of charge and curren densities. PODOLSKY, B. *Phys. Rev.*, **72**, 624–6 (*Oct.* 1 1947).—The components of ρv/c and $i\rho$ must transform as components of a 4-vector, so that if measured in on co-ordinate system they are known in all co-ordinat systems. On the other hand, any operational definitio of $\rho(\mathbf{r}, t)$ must take account of the positions of all particle at the same time t, that of the s-th particle being $\mathbf{r}_s(t)$. Upon performing the Lorentz transformation these wil be $\mathbf{r}'_s(t'_s)$, and the transformed time t'_s will be different for each particle. Another observer, in measuring ρ' would use $\mathbf{r}'_s(t')$, t' being the same for all particles. As particles are in motion $\mathbf{r}'_s(t'_s) \neq \mathbf{r}_s(t')$, and there appears to be no necessary relation between $\rho(\mathbf{r}, t)$ and $\rho'(\mathbf{r}', t')$, operationally defined in each co-ordinate system. It turns out, however, that if in each co-ordinate system the charge density is defined by $\rho(\mathbf{r}, t) = \Sigma_s e_s \delta(\mathbf{r} - \mathbf{r}_s(t))$, then relativistic equations of transformation hold. A.

530.14 3420

The motion of a particle in an electromagnetic and gravitational field. CORBEN, H. C., AND CORBEN, M.

s. Rev., **72**, 434 (*Sept.* 1, 1947).—An 8-invariant agrangian is defined by $L_\alpha = A_\alpha dq^\alpha/d\tau$ where A_α is 8-vector involving the mass and charge of the particle is a function of both position and velocity. The cial case where A_α is dependent on position is con-ered and an equation of motion is derived in which ain coefficients are interpreted as electromagnetic d strengths and others as gravitational potentials.
W. E. D.

.14 = 4 3421

On the proper mass of the meson. GIÃO, A. *C.R. ad. Sci., Paris*, **224**, 1275–7 (*May* 5, 1947) *In French.*—e masses of neutron, proton and meson can be ained by a theory that they are formed in a con-cting universe by the association of + and − electrons.
G. J. K.

.14 : 531.19 = 3 3422

A contribution on "intermediate" statistics. URBAN, P. *B. Akad. Wiss. Wien.*, **152**, *Abt. IIa* (*Nos.* 6–10) 111–35 943) *In German.*—Extensions are given of studies of the operties, including fluctuations and condensation enomena, of an assembly where the occupation mbers of the states have an upper limit d. This is ermediate to Bose-Einstein ($d = \infty$) and Fermi-Dirac = 1) statistics.
G. J. K.

0.14 : 537.122 3423

On the self-accelerating electron. ASHAUER, S. *Proc. mb. Phil. Soc.*, **43** (*Pt* 4) 506–10 (1947).—After solving e equations of motion of Dirac's self-accelerating ctron, a physical picture of it is formed by plotting aphically the surfaces of constant scalar potential when e electron has built up a velocity close to the velocity light.
A.

0.14 : 539.152.1 = 3 *see Abstr.* 3602

0.14 : 539.185.7 = 5 *see Abstr.* 3678

0.145 3424

On the Heitler theory of radiation damping. BLATT, M. *Phys. Rev.*, **72**, 466–77 (*Sept.* 15, 1947).—Heitler as developed a method of including radiation damping scattering problems. It involves an integral equation r the scattered field amplitude far from the scatterer. his integral equation has been derived classically for a ecial group of problems, allowing a comparison between e Heitler method and the Wentzel–Dirac λ-process. wo simple problems are discussed, involving the inter-ction of an oscillator with scalar and vector meson elds, respectively. Both problems have exact solutions, hich are compared with approximate solutions by the eitler method. This preserves the shape of the resonance ut neglects the shift in resonance frequency caused by the dditional mass of the oscillator coming from the coupling the meson field. The strong radiation damping en-ountered in vector meson theory appears in the second xample, although no spin interaction is assumed. The amping can be traced to the Lorentz condition $\partial U_l/\partial x_l|_{l=1}^4 = 0$ on the 4-vector field quantity U_l.
A.

30.145 : 530.12 *see Abstr.* 3417

30.145 : 531.19 = 3 3425

Quantum mechanical statistics and correlation calcula-ons. BOPP, F. *Z. Naturforsch.*, **2a**, 202–16 (*April*, 947) *In German.*—Usual statistical methods are incom-atible with the Heisenberg uncertainty principle, and herefore cannot be employed in quantum statistics. By the use of a matrix method of describing correlations, generalization of the usual methods is established which ncludes quantum and classical statistics as special ases.
G. J. K.

530.145 : 538.3 3426

Self-energy and interaction energy in Podolsky's generalized electrodynamics. GREEN, A. E. S. *Phys. Rev.*, **72**, 628–31 (*Oct.* 1, 1947).—Using a perturbation method, explicit expressions are derived for the electromagnetic self-energy and electromagnetic interaction energy of charged particles in Podolsky's generalized quantum electrodynamics [Abstr. 1906 (1945)]. No infinities arise in the derivation, which is justified to the first order of approximation (i.e. to terms quadratic in the charges). Two noteworthy results follow from the calculations: (*a*) The self-energy is finite and negative; (*b*) the interaction energy contains no singularities.
A.

530.145 : 539.153 *see Abstr.* 3608

530.145 : 539.18 *see Abstr.* 3661

530.145.6 3427

On the geometry of the wave equation. WATSON, A. G. D. *Proc. Camb. Phil. Soc.*, **43** (*Pt* 4) 491–505 (1947).—An account is given of the transformation of co-ordinates and of absolute axial frames in Euclidean space and Galilean space-time. The connection with Eddington's group of *E*-numbers is shown. The geometrical properties of Dirac's wave equation and of analogous equations in three dimensions are discussed in terms of absolute axial frames.
A.

530.145.6 3428

On first order wave equations for elementary particles without subsidiary conditions. WILD, E. *Proc. Roy. Soc. A*, **191**, 253–68 (*Nov.* 11, 1947).—The possibility of extending the application of the formalism used for the electron and meson fields, as developed from the equation $\partial_k \beta^k \psi = i\kappa\psi$ to other types of field, is investigated. It is shown that, subject to the conditions that (1) the equations must contain no subsidiary conditions; (2) either the total energy must be positive definite, or it must be possible to quantize the equations according to Fermi statistics without using an indefinite metric in Hilbert space, no such extension is possible.
A.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.19 : 530.14 = 3 *see Abstr.* 3422

531.19 : 530.145 = 3 *see Abstr.* 3425

531.382 3429

High centrifugal fields. BEAMS, J. W. *J. Wash. Acad. Sci.*, **37**, 221–41 (*July* 15, 1947).—A short review of some of the applications of ultra-centrifuges is followed by a comprehensive account of the design and performance of the instruments constructed by the author since 1935. Applications to high resolution molecular weight determination, and quantitative separation, including continuous flow, are mentioned. The attainment of very high speeds with small rotors is described, with diagrams of the circuits used, suspension and driving; centrifugal accelerations up to 4×10^8 *g* were obtained, with very constant speed of rotation up to 633 000 r.p.s.

531.382 : 533.12 *see Abstr.* 3436

531.51 : 530.12 *see Abstr.* 3418

531.553 : 533.6.011.5 *see Abstr.* 3441

MECHANICAL MEASUREMENTS 531.7

531.7 : 621.319.43 : 621.317.39 3430

A variable capacitor for measurements of pressure and mechanical displacements; a theoretical analysis and its experimental evaluation. LILLY, J. C., LEGALLAIS, V.,

AND CHERRY, R., *J. Appl. Phys.*, **18**, 613–28 (*July*, 1947).—[Abstr. 3037 B (1947)].

531.72 : 541.183.5 *see Abstr.* 3713

531.754 : 536.622 *see Abstr.* 3521

531.761 : 621.317.39 3431

The measurement of ultra-short time intervals. NEDDERMEYER, S. H., ALTHAUS, E. J., ALLISON, W., AND SCHATZ, E. R. *Rev. Sci. Instrum.*, **18**, 488–96 (*July*, 1947).—[Abstr. 3035 B (1947)].

MECHANICS OF LIQUIDS 532

532.122 : 536.63 : 536.48 = 5 *see Abstr.* 3513

532.13 : 666 : 539.2 *see Abstr.* 3681

532.137 = 3 3432

A new falling body viscometer for pressures up to 2 000 atmospheres. KUSS, E. *Naturwiss.*, **33**, 312–14 (*Nov.* 30, 1946) *In German.*—The disadvantages of previous forms are reviewed. In the present apparatus the liquid under test comes into contact only with glass and Hg, and the times of fall, which are measured electrically, are accurate to $\sim 0{\cdot}5\%$. Some results on a synthetic oil and on nitrobenzene are given. L. G. C.

532.516 : 539.23 *see Abstr.* 3682

532.517.4 3433

The measurement of double and triple correlation derivatives in isotropic turbulence. TOWNSEND, A. A. *Proc. Camb. Phil. Soc.*, **43** (*Pt* 4) 560–70 (1947).—By electrical analysis of the output from a hot-wire anemometer, it is possible to measure rapidly and accurately all the quantities appearing in the theoretical equations for the decay of isotropic turbulence. The technique for these measurements is described, and possible extensions and limitations of the method are discussed. Measurements have been made of the second and fourth derivatives of the longitudinal double-velocity correlation at the origin, the third derivative of the longitudinal triple-velocity correlation at the origin, the statistical distribution in time of the velocity fluctuations, and the integral scale of turbulence. A.

532.574.6 : 536.242 3434

Heat transmission from fine wires to water. PIRET, E. L., JAMES, W., AND STACY, M. *Industr. Engng Chem.*, **39**, 1098–1103 (*Sept.*, 1947).—Hot-wire anemometer data are presented for velocities lower than the Pitot tube range, and a wide range of water temps. and temp. differences. The data are correlated by means of dimensionless groups and empirical equations.

CAPILLARITY 532.6

KINETIC THEORY OF LIQUIDS 532.7

532.7 3435

A general kinetic theory of liquids. IV. Quantum mechanics of fluids. BORN, M., AND GREEN, H. S. *Proc. Roy. Soc. A*, **191**, 168–81 (*Nov.* 11, 1947).—[Abstr. 2792 (1947)]. In this paper the classical theory of liquids developed in the first three parts of this series is translated into the quantum formalism. After the fundamental equations have been reformulated, it is shown that in the classical limit $\hbar = 0$, they go over into the corresponding classical equations. A quantized proof of the Boltzmann distribution law is given which is simpler and more direct than that of the Darwin–Fowler method. Then the equation of state is derived in a form which exhibits clearly the deviations from the classical law at very low temps. An approx. method of solution of the fund mental equations is developed in a form suitable f practical application. Finally, the quantum equatio of motion and energy transport are obtained, and it shown that they are formally identical with the classic "hydrodynamical equations." This enables a discussic of the viscosity and thermal conductivity of quantu liquids to be given which exposes clearly the alternati explanations of the abnormal properties of liquid He II

MECHANICS OF GASES 533

533.12 : 531.382 34

The radial density variation of gases and vapors in centrifugal field. BEAMS, J. W. *Phys. Rev.*, **72**, 433 (*Sept.* 1, 1947).—Using the equation of state, $P = RT[(d/M) + B(d/M)^2 + C(d/M)^3 + \ldots]$, where d a M are respectively the density and molecular weight the gas or vapour and B, C, etc., are functions of characteristic of the gas, then an expression is derive giving, in terms of M, the density of the gas at a distance from the axis of a hollow centrifuge rotor when equil brium conditions have been established. The formul was tested on N_2, O_2 and CO_2 giving an accuracy bett than 1%. The method is suggested for the determina tion of the mol. weight of small amounts of radioactiv material. W. E. D

533.15 : 541.123.5 : 539.155.2 *see Abstr.* 3613

533.16 : 536.25 : 536.23 = 3 *see Abstr.* 3506

533.24 = 4 343

Association in gases and liquefaction. DUCLAUX, J. *J. Phys. Radium* (*Sér.* 8) **8**, 94–6 (*March*, 1947) *In French.*—See Abstr. 611 (1925), 3154 (1927), 4607 (1937).

533.275 343

Hygrometer for high pressure gases. BUECHNER, W. W. AND MCINTOSH, L. R. *Rev. Sci. Instrum.*, **18**, 586 (*Oct* 1947).

533.5 : 66.02 343

High vacuum technology. MORSE, R. S. *Industr Engng Chem.*, **39**, 1064–72 (*Sept.*, 1946).—The presen status of high vacuum technology is reviewed wit pictures of recently developed equipment and proces plants which employ pressures in the micron range Discussion is limited to industrial applications of vacuu techniques at 10^{-5} to 10^{-1} mm in such fields as de hydration, metallurgy, distillation, metal evaporation etc. Operating data on large diffusion pumps, gauges and steam ejectors are given with respective limitations Large scale operations are mentioned from the point o view of design and construction to illustrate the fact that in so far as technical problems of high vacuum *per s* are concerned, operations of any scale are now feasible. A

533.6.011.5 344

On explicit solutions of the equations for steady com pressible flow. HICKS, B. L. *Phys. Rev.*, **72**, 433 (*Sept.* 1 1947).—A method is described for obtaining exac solutions in this case under particular conditions especially in the trans-sonic region. W. E. D

533.6.011.5 : 531.553 344

The hodograph transformation in trans-sonic flow I. Symmetrical channels. II. Auxiliary theorems on th hypergeometric functions $\psi_n(\tau)$. III. Flow round a body LIGHTHILL, M. J. *Proc. Roy. Soc. A*, **191**, 323–6 (*Nov.* 18, 1947).

KINETIC THEORY OF GASES 533.7

VIBRATIONS . ACOUSTICS 534

114 3442

note to appraise some possible causes of the pres-/frequency effect of the tuning fork. JOHNSON, M. P. *ci. Instrum.*, **24**, 253–4 (*Oct.*, 1947).—Four causes are sidered: change of effective density of the tines with nge of density of carried air, change of damping with ge of pressure, change of fork dimensions with ge of pressure, and change of effective density of the due to change of thickness of the adhering moisture . An approx. calculation is made for each and com-d with an observed pressure/frequency coefficient. ppears that the change of density of the carried air is main cause. A.

.121.1 = 3 3443

hearing vibrations of square plates. MÄHLY, H., AND SCH, A. *Helv. Phys. Acta*, **20** (*No.* 3) 253–5 (1947) *German.*—The function containing the elastic moduli he formula for the frequency of shearing vibrations of quare plate is evaluated. Theoretical results are in eement with experiment. A. J. M.

.213.4 : 534.26 3444

The diffraction of sound due to right-angled joints in angular tubes. MILES, J. W. *J. Acoust. Soc. Amer.*, 572–9 (*July*, 1947).—The diffraction of a plane wave omputed by calculating the impedance elements of the ivalent circuit for the discontinuities, the propagation he principal wave being represented by the voltage and rent on a transmission line. A numerical example iven. A.

.213.4 : 534.26 3445

The equivalent circuit for a bifurcated cylindrical tube. LES, J. W. *J. Acoust. Soc. Amer.*, **19**, 579–83 (*July*, 47).—See Abstr. 1254 (1946). The equivalent cir-t elements are shown to be related to the analogous anges of cross-section. It is shown that the trans-tted power is divided between the two tubes resulting m the bifurcation in proportion to their areas and hout frequency distortion or reflection, and that the rcation may, therefore, be regarded as taking place in irtual plane parallel to, but somewhat removed from, geometrical plane. A formula is given to locate this ne. The results are applied to a concentric-circular rcation and to a rectangular-tube bifurcated parallel one of its walls. Numerical results are given which y be applied both to the circular change of cross-section d to the concentric bifurcation of a circular tube. A.

4.231.3 3446

Acoustical impedance of enclosures. DANIELS, F. B. *Acoust. Soc. Amer.*, **19**, 569–71 (*July*, 1947).—Formulae e derived for the acoustical impedance of three types of closures, a sphere, a cylinder and a narrow rectangular x. The solutions are valid throughout the entire range m adiabatic to isothermal conditions. A.

4.26 : 534.213.4 *see Abstr.* 3444

4.3 3447

An Institute of Musical Science—a suggestion. ETCHER, H. *J. Acoust. Soc. Amer.*, **19**, 527–31 (*July*, 47).

4.3 3448

The place of acoustics in the future of music. BURRIS-EYER, H. *J. Acoust. Soc. Amer.*, **19**, 532–4 (*July*, 47).

4.321.9 : 541.132 3449

The application of ultrasonic waves to the study of ectrolytic solutions. I. A modification of Debye's equa-on for the determination of the masses of electrolytic ions means of ultrasonic waves. BUGOSH, J., YEAGER, E., AND HOVORKA, F. *J. Chem. Phys.*, **15**, 592–7 (*Aug.*, 1947).—Debye's equation [Abstr. 1626 (1933)] for the alternating potential which should accompany the passage of ultrasonic waves through an electrolytic solution is modified and extended by the addition of terms representing corrections for relaxation forces, electrophoretic effects, thermal diffusion, and the pressure gradient associated with the material wave. A.

534.37 3450

Decay rates of piano tones. MARTIN, D. W. *J. Acoust. Soc. Amer.*, **19**, 535–41 (*July*, 1947).—Decay curves were recorded for an upright piano, a baby grand, and an electronic spinet. For some tones the partials were recorded separately. Decay rates for the electronic piano were measured at different levels of piano amplification. Analysis of the data reveals the degree of control exerted by the sounding board upon decay rate, particularly in the initial stage of decay. The significance of this control by the sounding board is discussed, in relation to the problem of electrical amplification of piano tones. A.

534.614 : 541.64 : 541.24 *see Abstr.* 3716

534.7 : 621.395.8 3451

The design of speech communication systems. BERANEK, L. L. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **35**, 880–90 (*Sept.*, 1947).—[Abstr. 3158 B (1947)].

534.75 3452

Frequency range preference for speech and music. OLSON, H. F. *J. Acoust. Soc. Amer.*, **19**, 549–55 (*July*, 1947).—In tests using natural music with and without a 5 000 c/s low-pass acoustic filter, the audience showed a decided preference for the full frequency range, the opposite result to that obtained using artificially reproduced music [Abstr. 2677 B (1945)].

534.756 : 612.858.71 *see Abstr.* 3759

534.76 : 612.858.71 = 5 *see Abstr.* 3760

534.83 3453

Physiological noise generated under earphone cushions. BROGDEN, W. J., AND MILLER, G. A. *J. Acoust. Soc. Amer.*, **19**, 620–3 (*July*, 1947).—Listeners were required to match the quality and intensity of a low frequency ambient noise to the quality and intensity of the noise which they heard when they held earphones over both ears. A sound-pressure of 55 or 60 db of rumbling, l.f. noise can be generated by the tremor of the tonic contractions of hand and arm muscles. A.

534.83 : 612.858.71 *see Abstr.* 3761

534.833.3 3454

On the transmission of sound through small apertures and narrow slits. INGERSLEV, F., AND NIELSON, A. K. *IngenVidensk. Skr* (*No.* 5) 62 *pp.* (1944).—Earlier theoretical results are extended to cover the case of thick walls with circular or rectangular apertures and with slits. Apart from resonance freqs., the transmittivity will be <1 for most of the small apertures occurring in practical acoustics. Experiments using plane waves in tubes and apertures in insulating walls are described, and the results correlated with earlier work and also with the new theory. In general, small apertures in building constructions have little effect on total sound insulation, although the importance of open slits round a common door is stressed. G. F. H.

534.845 3455

Acoustical properties of homogeneous, isotropic rigid tiles and flexible blankets. BERANEK, L. L. *J. Acoust. Soc. Amer.*, **19**, 556–68 (*July*, 1947).—Studies on rigid acoustical tiles and soft blankets are described. It is

shown that two waves travel through the material—one primarily airborne and the other primarily structure-borne. From a knowledge of the properties of the sample, the propagation constants of each of these waves can be calculated. The experimental results indicate that the theory is useful in calculating the performance of the flexible, airplane type of blankets over the entire audible frequency range. For rigid tiles, however, the theory appears to fail at frequencies $> 1\,000$ c/s if the flow resistance is high, and it fails at all frequencies for materials with low flow resistance. Experiment shows that the condensations and rarefactions of the gas in blankets take place isothermally at low frequencies and adiabatically at high. The transfer from one state to the other occurs gradually in the 100 to 2 000 c/s region. A more complete theory is required to explain the effects of thermodynamic and viscous losses on the propagation constant of rigid materials. A.

534.88 3456

Submarine detection by sonar. KELLER, A. C. *Bell Lab. Rec.*, **25**, 55–60 (*Feb.*, 1947).—The QJA underwater detection system has three main functions: sound listening, echo ranging, and telegraph communication with other ships fitted with suitable equipment. The transmitting and receiving electroacoustic transducer is an array of ammonium dihydrogen phosphate piezo-electric crystals; its efficiency is given as 80%. It is housed in a retractable streamlined dome which projects from the bottom of the ships' hull when in use. The transducer operates between 10 and 30 kc/s. For sound listening the supersonic signals received are demodulated to audible signals. The echo ranging system is similar to an ordinary radar system; the transducer can be rotated to find the bearing of the target. The operating frequency can be changed by resetting a single calibrated dial. For testing the transducers an "artificial ocean" was used. This was a water tank whose walls were treated so that they did not reflect the supersonic signals. P. O.

534.88 3457

The sonobuoy. *Electronics*, **19**, 154–5 (*April*, 1946).—A submarine detecting equipment released from a parachute over the sea. A magnetostriction hydrophone picks up under-water noises and drives a 70 Mc/s 0·1 W f.m. transmitter, using a telescopic $\frac{1}{4}\lambda$ aerial. Max. range for aircraft pick-up is about 50 miles. After a few hours the sonobuoy sinks. H. G. M. S.

OPTICS . RADIATION . SPECTRA 535

535.214–15 : 778.344 = 4 *see Abstr.* 3766

535.233 3458

A table of logarithmic corrections to the Wien radiation law. ADAMS, E. Q. *J. Opt. Soc. Amer.*, **37**, 695–7 (*Sept.*, 1947).—For many purposes the Wien radiation law is a sufficiently close approximation to the Planck equation. When it is not, the subtraction in the denominator of the Planck equation interferes with ogarithmic calculation. A table is given which can be entered with the negative of the exponent of the Wien equation, expressed in terms of common logarithms: $c_2 \log e/\lambda T$, to get the logarithmic correction to 4 significant figures. Moreover, the same table can be used if successive approximations are necessary. A.

535.243 3459

The performance of a quartz double monochromator in an improved and more versatile photoelectric spectrophotometer. ZSCHEILE, F. P. *J. Phys. Coll. Chem.*, **51**, 903–26 (*July*, 1947).

535.247.1 : 771.534.53 = 3 346

Method for establishing an intensity scale in photographic photometry. PAETZOLD, H. K. *Z. Naturforsch.* **2a**, 219–26 (*April*, 1947) *In German.*—A convenient method for obtaining the scale of blackening of a photographic plate is to use the theoretical variation of intensity of the diffraction pattern produced by a slit which is wide in comparison with the wavelength of the light used but narrow in comparison with the distances of the slit from the source and from the plate. The errors introduced by departures from the ideal conditions, especially when using short-wave light, are examined theoretically and the application of the method to the calibration of a I. step-wedge is described. J. W. T. W.

535.247.4 : 535.345.6 : 621.383 346

Filters for spectral corrections of multiplier photo-tubes used from scotopic to photopic brightness levels. PIRENNE, W. S., JR. *Rev. Sci. Instrum.*, **18**, 535–9 (*Aug.* 1947).—Filter glass numbers and thicknesses are given for the correction of RCA multiplier phototubes 1P21 and 1P22 to have spectral response characteristics similar to the adapted eye at various brightness levels covering the Purkinje range. Used in this way, the tubes are satisfactory for photometric work over a wide range.

535.31 : 535.42 = 4 *see Abstr.* 3495

535.31 : 535.42 = 4 346

Study of the combined effects of diffraction and geometrical aberrations on the image of a luminous point. MARÉCHAL, A. *Rev. Opt. (Théor. Instrum.)* **26**, 257–73 (*Sept.*, 1947) *In French.*—Treatment of the influence of small aberrations on the central intensity of the diffraction pattern constituting an optical image. It is shown that the intensity $\propto [1 - (2\pi^2/\lambda^2)E_0]^2$, where E_0 is the minimum of E, the mean squared deviation of the wave front from a given sphere of reference. This expression is used to study the permissible tolerances on aberration and focusing. H. H. HOPKINS

535.313 : 537.531 *see Abstr.* 3551

535.327 : 548.0 34

Thermo-optic behaviour of solids. IV. Zinc-blende. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, 2 375–81 (*April*, 1947).—At all wavelengths the refr. ind. of zinc blende increases on heating. The general theory in Part I [Abstr. 2479 (1947)] satisfactorily explains the variation of $dn/d\theta$ with wavelength and the $\theta - n$ curve from −80° to 700° for different wavelengths. The ultra-dispersion frequency at 2 532 Å alters considerably with θ, the rate of change being $\sim 10\times$ that of diamond and diminishing as θ is lowered. W. R.

535.327 : 548.0 34

Thermo-optic behaviour of solids. V. Alkali halides. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, 2 481–97 (*June*, 1947).—Rock-salt, sylvine, and KI have been investigated and the results are successfully explained by the author's general theory. Dispersion data for alkali halides are reviewed and a dispersion formula of the Drude form is favoured for these salts. W. R.

535.327 : 666.22 34

Thermo-optic behaviour of solids. VI. Optical glass. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, 2 498–514 (*June*, 1947).—Various optical glasses have been measured. Formulae, based on the dispersion formula of Huggins *et al.*, are derived but do not completely fit experimental data. By modifying the Huggins' formula through using two frequencies for each oxide component new dispersion formulae are obtained which yield close agreement with observed results. W. R.

127 : 549.514.51 3466
mperature variation of the refractive indices of quartz. HAKRISHNAN, T. *Proc. Indian Acad. Sci. A*, **26**, 8 (*April*, 1947).—The temp. variation has been stigated and the results quantitatively interpreted on iachandran's theory [Abstr. 2479 (1947)]. W. R. A.

33 : 537.228.5 = 3 3467
method for the determination of the *f*-values from the k effect. PAUL, W. *Z. Phys.*, **124** (*Nos.* 1–2) 121–8 7) *In German.*—The method, a straightforward ication of the perturbation theory, is applied to the $^2P_{1/2,\ 3/2}$ terms of Na. For the transition $3^2P_{1/2,\ 3/2} - {}^2P_{1/2,\ 5/2}$ it is found that $0{\cdot}85 < f_{3D} < 0{\cdot}93$; and, for the sition $3^2P_{1/2,\ 3/2} - 4^2S_{1/2}$, $0{\cdot}14 < f_{4S} < 0{\cdot}17$. L. P.

33 : 538.615 = 4 3468
ie Zeman effect of multipole lines in the classical ation theory. DURAND, E. *J. Phys. Radium* (*Sér.* 8) 33–9 (*Dec.*, 1946) *In French.*—The classical theory of Zeeman effect is extended to (singlet) lines due to tipole radiation. L. P.

33.03 : 537.542 3469
ydrogen discharge tube. ARNOLD, G. B., AND DONN, *Industr. Engng Chem.* (*Analyt. Edit.*) **19**, 666–7 *t.*, 1947).—The discharge in the Pyrex tube described oncentrated in a capillary which can be viewed end-on roduces sufficient intensity of the *C* and *F* H lines measurements with an Abbe refractometer; current sumption is low, and it may be operated continuously several hours.

33.072 : 545.822/3 *see Abstr.* 3719

333 + 535.343 = 3 3470
Complex spectra of manganese halides. BACHER, J., MIESCHER, E. *Helv. Phys. Acta*, **20** (*No.* 3) 245–7 47) *In German.*—The spectra of MnF and MnI have n investigated. The emission system of MnF consists 5 groups between 3 670 and 3 330 Å. The emission ctrum of MnI consists of strong Mn lines and no nds. In absorption a new spectrum was obtained logous to the complex spectra of the lighter halides. A. J. M.

5.338.332 : 539.152.1 *see Abstr.* 3603–4

5.338.4–15 3471
The band-spectrum of beryllium oxide between 0000 Å and λ11600 Å. LAGERQVIST, A. *Ark. Mat. ir. Fys.*, **34 B** (*Paper* 23) 6 *pp.* (1947).—An extension of rlier work [Abstr. 2242 (1945)] has led to new values the constants of the lowest $^1\Pi$ state of BeO. The stem-origin is now placed at 9 405·18 cm^{-1}, $\omega_e = 44{\cdot}56$, $x_e\omega_e = 8{\cdot}464$ and $B_v = 1{\cdot}3663 - 0{\cdot}01587(v + \frac{1}{2})$. rther perturbations are reported. R. F. B.

5.338.4–31 3472
Emission bands of halogens. V. Continuous bands of lorine. VENKATESWARLU, P. *Proc. Indian Acad. i. A*, **26**, 22–30 (*July*, 1947).—Wavelengths of the axima of continuous bands of Cl_2 in the u.v. obtained th uncondensed transformer discharge are given, and dicate that the spectrum of Cl_2 is similar to those of $_2$ and I_2. The bands are arranged in three sets. The ial states of all the bands will be repulsive and will have eep potential energy curves. The potential energy agram for Cl_2 is given. W. R. A.

35.342 : 535.375.5 : 539.132 = 4 *see Abstr.* 3595

35.343 + 535.333 = 3 *see Abstr.* 3470

35.343 : 539.13 3473
Contribution to the study of electronic spectra of bent iatomic molecules. DUCHESNE, J., AND ROSEN, B. *Chem. Phys.*, **15**, 631–44 (*Sept.*, 1947).—The electronic absorption spectra of the SO_2, SeO_2 and TeO_2 molecules have been studied under widely varied experimental conditions. The vibrational analysis of the u.v. absorption region of SO_2 with centre of gravity near 2 000 Å reveals that it is formed by at least two electronic systems; the presence in the same region of a third system seems highly probable. Some information about the molecular structure of the excited states has been obtained. The vibrational analysis of the *c*-system of SeO_2 in the visible, and the TeO_2 bands in the visible and u.v., have enabled the electronic states of the three similar molecules to be correlated. A.

535.343.2 : 538.615 = 3 3474
The absorption spectrum of neodymium fluoride, NdF_3. CHOW, Y. K. *Z. Phys.*, **124** (*Nos.* 1–2) 52–67 (1947) *In German.*—The absorption spectrum of crystalline NdF_3 has been investigated in the range 4 500 to 9 000 Å at liquid air temperature, and the wavelengths of 9 groups of lines are given. The lines which result from electronic transitions, rather than lattice vibrations, have been identified: the groups arise by term-splitting in the electric field of the crystal. In an external magnetic field, further splitting occurs, from which *J*-values of excited levels have been deduced. R. F. B.

535.343.2 : 548.0 : 535.66 3475
Spectral location of the absorption due to color centers in alkali halide crystals. IVEY, H. F. *Phys. Rev.*, **72**, 341–3 (*Aug.* 15, 1947).—The wavelengths of max. absorption due to electrons trapped in alkali halide crystals are collected in a table. For salts with the NaCl structure they are represented fairly well by empirical formulae of the type $\lambda_{max} = Ad^n$ (d = interionic distance in the salt; A and n are constants for each band). A. J. C. W.

535.343.2–15 : 548.7 : 539.133 = 4 3476
Absorption of polarized infra-red radiation by crystals and the structure and binding of H_2O and OH groups. II. LOUISFERT, J. *J. Phys. Radium* (*Sér.* 8) **8**, 45–55 (*Feb.*, 1947) *In French.*—[Part I, Abstr. 3125 (1947)]. Experimental results are given for the following sulphates: $ZnSO_4 . 7H_2O$, $CuSO_4 . 5H_2O$ and $CdSO_4 . \frac{5}{3}H_2O$. The bearing of these observations and of those on the silicates (Part I) on the state and position of water in the crystals is discussed. R. F. B.

535.343.2–31 = 3 3477
The position of the ultraviolet absorption edge in molten alkali halides. MOLLWO, E. *Z. Phys.*, **124** (*Nos.* 1–2) 118–20 (1947) *In German.*—The wavelength of the absorption edge in KBr, KCl and KI increases approximately linearly with the temp. up to the melting points; there is a discontinuous increase equivalent to ~ 0·7 eV on melting. A. J. C. W.

535.343.3/.4–15 3478
Infrared absorption spectrum of carbon disulfide. PLYLER, E. K., AND HUMPHREYS, C. J. *J. Res. Nat. Bur. Stand., Wash.*, **39**, 59–66 (*July*, 1947).

535.343.31–32 3479
Absorption spectrum of borazole in the vacuum ultraviolet. PLATT, J. R., KLEVENS, H. B., AND SCHAEFFER, G. W. *J. Chem. Phys.*, **15**, 598–601 (*Aug.*, 1947).

535.343.4–14 : 539.152.2 : 539.133 *see Abstr.* 3598

535.343.4–15 3480
Absorption by hydrogen sulfide in the 3·5μ–4·5μ region. WILSON, E. A., JR., AND CROSS, P. C. *J. Chem. Phys.*, **15**, 687 (*Sept.*, 1947).

535.343.4–15 : 539.133 3481
The infra-red spectrum of ketene. HALVERSON, F., AND WILLIAMS, VAN Z. *J. Chem. Phys.*, **15**, 552–9 (*Aug.*, 1947).—The infra-red spectrum of gaseous ketene has

been studied from 2·5 μ to 25 μ with a spectrometer using LiF, NaCl, and KBr prisms. A perpendicular band at 3 162 cm^{-1} with components relatively free of perturbations has been resolved, and the intensity alternation associated with the twofold axis observed. All fundamental vibrational frequencies have been assigned. A normal co-ordinate treatment of the general H_2XYZ molecule has been made and reasonable force constants for ketene calculated. A.

535.343.4–31 3482

The absorption spectrum of InCl. FROSLIE, H. M., AND WINANS, J. G. *Phys. Rev.*, **72**, 481–91 (*Sept.* 15, 1947).—The vibrational, rotational, and electronic energy levels associated with the band system in the region 2 650 to 3 000 Å have been determined. The B' and B''_0 values were found to be $\sim$0·11 wave numbers, from which can be calculated a nuclear separation of the order of $2{\cdot}3\times10^{-8}$ cm. Predissociation in the band system provided a value for the energy of dissociation of the ground state between 4·64 and 4·66 eV. A.

535.343.4–32 = 3 3483

On the absorption spectrum of thiophene vapour in the quartz ultra-violet at room temperatures. MILAZZO, G. *Experientia*, 3 (*No.* 9) 370 (1947) *In German.*—The spectrum has been photographed with large dispersion so as to attempt the vibrational analysis of the bands. All the bands observed between 2 600 and 2 000 Å are attributed to two or three electronic transitions. The first has a final level *B*, which seems characteristic for substances of an aromatic nature, even heterocyclic ones. The vibrations coupled with this transition are all of the total-symmetrical type, excepting one, for which the electronic transition would thereby be only partially forbidden. In the same spectral region another electronic transition is not improbable, with a final state of a similar type. The bands in the outermost portion of the spectrum, on the contrary, are attributed to an electronic transition, of which the final level *C* is common, both in existence and characteristics, to the other pentatomic heterocyclic molecules. A.

535.345.6 3484

Neutral density filters of Chromel A. BANNING, M. *J. Opt. Soc. Amer.*, **37**, 686–7 (*Sept.*, 1947).—A short review of the available neutral density filters is given, with emphasis placed on the evaporation of Chromel A to form films of any practical density, having neutral transmission throughout the visible and into the infra-red and ultraviolet regions. These films are simple to make and have proved to have good durability, resisting corrosion and rough handling. A.

535.345.6 : 535.421 *see Abstr.* 3496

535.345.6 : 621.383 : 535.247.4 *see Abstr.* 3461

535.37 3485

The preparation of strontium selenide and its properties as a base material for phosphors stimulated by infrared. SMITH, A. L., ROSENSTEIN, R. D., AND WARD, R. *J. Amer. Chem. Soc.*, **69**, 1725–9 (*July*, 1947).—The preparation is described for SrSe suitable for use in preparing infra-red-stimulated phosphors with the activator pairs: Bi–Mn, Bi–Pb, Cu–Bi, Cu–Pb, Eu–Pb, Eu–Bi, Sm–Bi, Sm–Ce. The sensitivity of the last four is increased by traces of sulphide or oxide. Stimulation spectra are given for various phosphors. W. R. A.

535.371 3486

The sensitized luminescence of manganese-activated calcite. SCHULMAN, J. H., EVANS, L. W., GINTHER, R. J., AND MURATA, K. J. *J. Appl. Phys.*, **18**, 732–9 (*Aug.*, 1947).—Synthetic Mn-activated calcites are shown to be practically inert to u.v. excitation in the range 2 000 3 500 Å, while they are luminescent under cathode-ra excitation. The incorporation of small amounts of a auxiliary impurity along with the Mn produces the stron response to u.v. radiation hitherto ascribed to $CaCO_3$:M itself. Three such impurities have been studied: Pb, T and Ce. The first two induce excitation in the neighbou hood of the Hg resonance line, while the Ce introduces response principally to longer wave u.v. The stron response to 2 537 Å excitation shown by some natur calcites is likewise found to be due to the presence of P along with the Mn, rather than to the Mn alone. Th data do not warrant ascribing the longer wavelengt u.v.-excited luminescence of all natural calcites to th action of an auxiliary impurity. The essential identit of the cathode-ray excited luminescence spectra $CaCO_3$: Mn, $CaCO_3$: (Pb + Mn), $CaCO_3$: (Tl + Mn and $CaCO_3$: (Ce + Mn) with the 2 537 Å-excited spectr of the latter three is evidence that the luminescent centr in all cases is the Mn ion or the MnO_6 group. It is show that a "cascade" mechanism for the action of the auxiliar impurities, Pb, Tl and Ce, is incorrect; and that th phenomenon must be considered as a case of sensitize luminescence. Owing to the nature of cathode-ra excitation, the Mn activator can be excited by this ager even in the absence of a second impurity. For optica excitation, however, an absorption band for the u.v. mus be established by building into the $CaCO_3$:Mn a secon impurity or "sensitizer." A.

535.371 = 4 348

Photoluminescence of zinc sulphide. SADDY, J. *Ann Phys., Paris* (*Sér.* 12) **2**, 414–55 (*July–Aug.*, 1947) *French.*—Experiments are described showing that trace of Fe, Ni or Co destroy practically all the luminescenc at concentrations at which the photoconductivity is sti very appreciable. These results are taken as indicatin that the Perrin theory of the extinction effect of thes elements is correct, i.e. that the electrons liberated unde the excitation return, not to the parent centre, but to th extinguishing atom or centre associated therewith withou emission of light. These same extinguishing element also sensitize the sulphide to the effects of infra red, i.e make it more rapidly darkened than without them. A very detailed description is given of the apparatus use and measurements made to determine the law of decay It is concluded that the decay cannot be represented b any single term law but may be by either an exponentia or hyperbolic series, the first requiring, e.g. 5 terms an the second 9 terms in the case of ZnS . Cu. From thes series an attempt is made to evaluate the distribution o the groups of metastable states relative to the conductio levels ("trap" levels). J. I.

535.371.07 : 778.33 *see Abstr.* 3765

535.372 348

Decay of luminescence due to forbidden optical transi tions. GARLICK, G. F. J., AND GIBSON, A. F. *Nature Lond.*, **160**, 303 (*Aug.* 30, 1947).—Inclusion of Eu ion in Sr silicate gives rise to a temp.-independent lumines cence of decay time 2·3 sec, this decay being precede by a faster component of very short life-time. Bot appear for excitation by 3 650 and 2 537 Å, but th shorter wavelength also produces a long-duration temp dependent luminescence, associated with thermo-lumi nescence characteristic of a single depth of electron tra of 0·75 eV.

535.375.5 : 535.342 : 539.132 = 4 *see Abstr.* 3595

535.375.5 : 548.0 348

Second-order Raman spectra of crystals. KRISHNAN R. S. *Nature, Lond.*, **160**, 230–1 (*Aug.* 16, 1947).

.39 3490

n the exact calculation of the reflectance of glass ed with an arbitrary number of non-absorbing layers. ISSE, B. S., AND VAN DER SANDE, J. J. *Physica, 's v.*, **13**, 413–16 (*Aug.*, 1947).—Considers the case of - 2 such layers, medium 1 being glass and medium *N* g air or a vacuum. By introducing vector potentials the various waves and applying boundary conditions ach interface, a formula for the reflectance is obtained. he special cases of 1 and 2 layers, the general formula uces to those given by Blodgett and Mooney re- ctively. H. H. HOP.

.39 3491

artially reflecting mirrors of high efficiency and ability. BANNING, M. *J. Opt. Soc. Amer.*, **37**, 688–9 *pt.*, 1947).—A description is given of the preparation very durable TiO_2 films on glass by hydrolysis of Cl_4. A single coating reflects 30% and transmits 70% incident light. The reflectivity can be increased to 0% in the visible range by alternate layers of TiO_2 d MgF_2. A.

.39 = 4 3492

Calculation of the reflecting power of any stratified tem. HERPIN, A. *C.R. Acad. Sci. Paris*, **225**, 182–3 *ly* 21, 1947) *In French.*—The e.m. field in any layer is presented by a simple matrix. The boundary conditions at any interface yield a recurrence formula ating the fields in the first and last media. This gives pressions for the reflection and transmission of the tem. H. H. HOP.

.39 : 539.23 3493

Three-layered reflection-reducing coatings. LOCKHART, B., JR., AND KING, P. *J. Opt. Soc. Amer.*, **37**, 689–94 *pt.*, 1947).—An analysis of the various factors involved several typical 3-layered reflection-reducing coatings s been made from both an experimental and a oretical standpoint. By taking into account the proximate dispersions of the materials, reasonable reement between the experimental and calculated flection curves has been obtained. Interesting results re obtained on electron diffraction studies of the rious coating materials. Thin films of TiO_2, the high dex material used, were found to have crystalline tterns that varied with the coated material and that, general, were not recognizable as TiO_2 patterns. hus it was considered impossible to assign any definite lues to the refractive indices of such thin films without ecifying the substrate. A.

35.417 : 535.833 3494

Interferometer studies of telescopic systems. COLEMAN, . S., CLARK, D. G., AND COLEMAN, M. F. *J. Opt. Soc. mer.*, **37**, 671–84 (*Sept.*, 1947).—Photographs of interrence patterns caused by various individual and ixtures of common aberrations are shown, and these gree well with patterns computed by the "optical" ath-difference method. Two uses of interferometers in utine testing of telescope systems are described; in one e diameter of the largest circle which can be inscribed a single interference area of the pattern obtained when he telescope is optically focussed, is taken as the "Interferometer Quality," and is found to be a reliable measure f the optical resolving power. A.

35.417 : 549.211 : 548.574 *see Abstr.* 3723

35.42 : 535.31 = 4 3495

Calculation of diffraction patterns associated with upils of revolution. LANSRAUX, G. *Rev. Opt.* (*Théor. Instrum.*) **26**, 278–94 (*Sept.*, 1947) *In French.*—See Abstr. 497 (1947). An evaluation of the diffraction integral for spherical aberration and defect of focus by means of expansion of a factor in the integrand in terms of polynomials. H. H. HOP.

535.42 : 535.31 = 4 *see Abstr.* 3462

535.421 : 535.345.6 3496

Gratings as broad band filters for the infra-red. WHITE, J. U. *J. Opt. Soc. Amer.*, **37**, 713–17 (*Sept.*, 1947).—An effective means of removing the short wavelength light from a beam containing infra-red radiation of all wavelengths, uses an echelette grating as a simple mirror. Light of wavelengths $\ll$ the grating space, is diffracted out of the beam into the dispersed spectra. Light of wavelengths $\gg$ the grating space, can only go into the undispersed zero-order spectrum, which falls in the direction of normal reflection if the grating were a mirror. By the use of echelette gratings with high intensities in the dispersed spectra, large reductions in the amount of short wavelength light in the central image can be effected. The wavelength at which most of the light changes from normal reflection into the beam to diffraction out of it, may be quite sharp, so that the effective filtering action may vary by a factor as large as 4 in a 2 μ interval. When such a grating is substituted for a plane mirror in the illuminating system of an infra-red spectrometer, the scattered light in the monochromator is reduced by a factor of 10. A.

535.43 : 551.593.55 *see Abstr.* 3742

535.515 : 548.0 = 4 3497

Variations in birefringence with wavelength and temperature. BARBARON, M. *C.R. Acad. Sci., Paris*, **225**, 52–3 (*July* 7, 1947) *In French.*—A modification of Havelock's formula for birefringence, which takes the density, the wavelength and (to an approx. extent) the temp., into account, is deduced. It is of special value for obtaining the birefringence associated with molecular orientation, and it is in accord with Langevin's theory and with much experimental data; in other cases (e.g. with calcite) the experimental values fall between those given by the new formula and that of Servant. Disymmetry in the intensity of absorption bands is the principal cause of birefringence. J. G.

535.515.096 : 548.0 3498

Birefringence of crystals and its temperature variation. I. Calcite and aragonite. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, **26**, 77–92 (*July*, 1947).—Birefringence of crystalline substances, it is suggested, is due to the existence of polarized electronic transitions so that the probability of transition is different for different directions of the incident electric vector. Applying this view to calcite and aragonite, dispersion formulae involving 3 u.v. frequencies are derived. These formulae show that a large part of the birefringence arises from the large anisotropy in the strength of the shortest u.v. frequency; and, further, that they can explain the thermo-optical behaviour of both compounds when used in the author's general theory of thermo-optical behaviour [Abstr. 2479 (1947)], provided that account is taken of the principle that, although the total oscillator strength does not alter with temp. the individual strengths along the three principal directions can change and give rise to a mutual transfer. This transfer is possibly related to the differences in thermal expansion along the three directions. W. R. A.

535.563.096–31 3499

Temperature coefficient of rotation of quartz in the ultra-violet region. CROOK, A. M., AND TAYLOR, A. M. *Nature, Lond.*, **160**, 396 (*Sept.* 20, 1947).—A value of $1{\cdot}44\times10^{-4}$ was obtained, which agrees with that in the visible region.

535.653.33 3500

Chromaticities of Lovibond glasses. HAUPT, G. W., AND DOUGLAS, F. L. *J. Opt. Soc. Amer.*, **37**, 698–706 (*Sept.*, 1947).

535.66 : 548.0: 535.343.2 *see Abstr.* 3475

535.822 3501

The polanret microscope. OSTERBERG, H. *J. Opt. Soc. Amer.*, **37**, 726–30 (*Sept.*, 1947).—Variable contrast in the image of non-uniform objects is obtained by polarizing orthogonally the deviated and undeviated bundles of light due to diffraction by the object. Advantage is taken of this orthogonality of polarization to effect variable phase difference between, and variable amplitude ratio of the deviated and undeviated bundles. These modified, interfering bundles produce the image and permit continuously variable contrast. Of many possible polanret systems two are described. In the preferred system, the phase difference between the deviated and undeviated bundles is varied throughout one wavelength by rotation of the polarizer, and the amplitude ratio is varied practically in all proportions by rotation of the analyzer. The light is plane polarized either before or after passage through the object, passes through a uniform $\lambda/4$ plate, through the zonal polarizer, and finally through the analyzer. The zonal polarizer consists of two thin, adjoining, plane-polarizing elements oriented at right angles. One element covers the image of the condenser diaphragm as formed by the intervening lenses of the condenser and objective, the other, the remaining area of the clear aperture. The principal axes of the $\lambda/4$ plate bisect the transmission directions of the zonal polarizer. Wide range in contrast has been obtained with experimental polanret systems with microscope objectives of long focal length. A.

535.822 3502

On interference microscopy. MERTON, T. *Proc. Roy. Soc. A*, **191**, 1–6 (*Sept.* 26, 1947).—Except for very thin specimens, the permissible angular aperture is very small. By the use of a zone-plate in the front focal plane of the condenser an angular filter is obtained for the illuminating beams. The metallized specimen itself constitutes a second angular filter, the permitted directions being a function of the optical thickness. Thus, given a suitable zone-plate, light will be seen or not depending upon the optical thickness of the specimen. H. H. HOP.

535.83 : 620.11 = 397 3503

Collimators and autocollimators for workshop control. VOGL, J. G. *Tekn. Tidskr.*, **77**, 655–8 (*Sept.* 6, 1947) *In Swedish.*—Describes various applications and special adaptations. H. H. HOP.

535.833 3504

The reduction in image contrast caused by the aberrations in telescopic systems. COLEMAN, H. S. *J. Opt. Soc. Amer.*, **37**, 684–6 (*Sept.*, 1947).—A study has been made of the reduction in image contrast caused by optical aberrations in telescopic systems. Visual measurements were made of the resolution of telescopic systems, in which the amount of aberration could be varied continuously, and in a number of telescopic systems of current design. The resolution measurements were made using Foucault test objects of high contrast [Abstr. 2472 (1947)]. The contrast of the image of the test object on the retina was determined at the limit of resolution for the various telescopic systems. This contrast was found to have a value of approximately 4% for telescopic systems free from all aberrations. From a knowledge of the contrast required by the retina for resolution and the loss in resolution caused by different magnitudes of the aberrations, it was possible to compute the reduction i image contrast caused by the aberrations.

535.833 : 535.417 *see Abstr.* 3494

535.89 : 621.325.53 350

Modulation of the resonance lines in a cesium ar FRANK, J. M., HUXFORD, W. S., AND WILSON, W. F *J. Opt. Soc. Amer.*, **37**, 718–25 (*Sept.*, 1947).—A detaile study has been made of the electrical characteristics an light-modulation properties of a 90 W Cs vapour ar having a 3-in column. The range of frequencies use extend from 100 to 10^6 c/s. When operated on a d. biasing current of 5 A, the arc has a positive resistanc below 20 000 c/s its reactance is inductive, while abov this frequency the reactance is chiefly capacitative. Th modulation ratio for the resonance lines at 8 521 Å an 8 944 Å has a nearly constant value of 0·85 belo 2 000 c/s, and for higher frequencies $\propto$ (frequency)$^{-\frac{1}{2}}$. A

HEAT 536

536.23 : 536.25 : 533.16 = 3 350

On the influence of electric fields on transport phenomen in gases consisting of molecules without dipole moment BECKER, W. E. *Z. Naturforsch.*, **2a**, 297–303 (*Ma* 1947) *In German.*—The effect of a radial electric field o the heat transfer between two horizontal concentric tube is investigated. In a field of 90 kV/cm and at a pressur of 16 atmos. the heat transfer is decreased or increased b $\sim$40% according to whether the inner tube is hotter o colder than the outer. This can be accounted for b considering the influence of the field on the convectio process. The arrangement can be used for the dete mination of the permittivities of gases. In a differer arrangement the effect of electric fields on viscosity i investigated and no effect (to 0·5%) is found at 90 kV/c and 16 atmos. For these measurements a sensitiv differential manometer has been designed in which a aperture is closed by the force exerted by a moving co instrument. The measurements indicate that the electri fields have no effect on the heat conductivity. H.

536.24 350

Heat flow through composite cylinders. PENNER, S. S AND SHERMAN, S. *J. Chem. Phys.*, **15**, 569–74 (*Aug* 1947).—The differential equations are solved for th time-dependent flow of heat through a composite cylinde The composite cylinder is assumed to be thermall insulated at the outer boundary and to consist of cylindrical core, initially at the uniform temp. U_0, su rounded by a cylindrical shell, initially at zero temp Corresponding treatments for composite slabs of finit and ∞ widths are included. A

536.242 : 532.574.6 *see Abstr.* 3434

536.25 : 533.16 : 536.23 = 3 *see Abstr.* 3506

536.423.15 350

Determination of vapor pressures below 10^{-3} mm H KAPFF, S. F., AND JACOBS, R. B. *Rev. Sci. Instrum.*, **1** 581–5 (*Aug.*, 1947).—A method based on kinetic theor principles has been developed whereby the slope of th vapour-pressure/temp. curve of a liquid can be obtaine at 25°C when the vapour pressure is $\sim 10^{-7}$ mm Hg a this temp. A simple apparatus consisting of a boiler, sl system, and target is used to determine a dew point of th material under high vacuum, from which the slope ca be calculated directly. If in addition a single value i known by other methods for the vapour pressure in th region of 10^{-3} mm then the value at 25°C is easily found The results are believed to be accurate to 30%, as cor trasted with other methods which give errors of sever hundred % in this region.

24 + 536.656 + 536.63 *see Abstr.* 3522

·24 : 537.228.1 *see Abstr.* 3530

:4 3509

rata: On the behavior of pure substances near the al point. RICE, O. K. *J. Chem. Phys.*, **15**, 615 ., 1947).—See Abstr. 2136 (1947).

46 = 3 3510

ependent flames and their ignition. MACHE, H. *Akad. Wiss. Wien.*, **155**, *Abt. IIa* (*Nos* 5–6) 205–20 7) *In German.*—The ignition of a combustible gas- ure by means of a flame, a glowing filament, or an tic spark, leads only to a continuation of the bustion independently if the composition of the gas- ure lies between certain ignition limits. Only in such s can a definite combustion surface be formed in the for propagation of the combustion into the neigh- ring layers. Outside the ignition limits, combustion nomena occur without formation of a definite com- tion surface, and are designated "dependent flames," e they are extinguished when the igniting agent is oved. Experimental details and illustrations are given cases where the above agents function. H. H. HO.

.48 3511

On a connection between the fountain effect, second nd, and thermal conductivity in liquid helium II. ZA, L. *Phys. Rev.*, **72**, 353–4 (*Aug.* 15, 1947).—It is nted out that Meyer and Band [Abstr. 2547 (1947)] e omitted a factor ρ/ρ_s from their analysis and that s correction then assures that the second sound ocity $\rightarrow 0$ as $T \rightarrow T_\lambda$ as required by experiment. W. E. D.

.48 3512

Liquid helium and its properties. MENDELSSOHN, K. *ture, Lond.*, **160**, 385–7 (*Sept.* 20, 1947).—Report of a nference in Oxford, June, 1947. The main discussion s on: Born and Green's kinetic theory of liquids; flow liquid He II through capillaries and slits; properties of transfer film which covers all solid surfaces in contact th liquid He II. Four methods of measuring the latter re described, and also experiments on its behaviour ider different vapour pressure conditions.

6.48 : 536.63 : 532.122 = 5 3513

On some physical properties of He II. CALDIROLA, P. *uovo Cim.*, **1**, 205–16 (*June*, 1943) *In Italian.*—Applica- n to the ideal gas theories of (*a*) Gentile [Abstr. 1204 947)] and (*b*) F. London [Abstr. 108 (1939)] of the teraction introduced by Bijl, de Boer and Michels Abstr. 3514 (1947)]. The result is a max. of the specific at at the λ-point; in case (*b*) there is also a discontinuity. lthough the latter behaviour is in agreement with periment, (*b*) gives an ∞ compressibility below the -point, which is in disagreement. (*a*) gives no dis- ntinuity of the compressibility. H. L.

36.48 : 536.63 : 539.23 3514

Properties of liquid helium II. BIJL, A., DE BOER, J., ND MICHELS, A. *Physica, 's Grav.*, **8**, 655–75 (*July*, 941).—The theory of the ideal Bose–Einstein gas is odified for liquid He II by assuming that an excitation nergy is required to raise an atom from the ground state o the lowest excited state, and at the lowest temps the pecific heat can be brought into agreement with the xperimental data. The thickness of surface films is xplained as being due to an additional zero-point energy ependent on the dimensions of the vessel. The max. ow velocity in very thin layers and narrow capilliaries epends on d, the thickness or diameter respectively, ccording to the formula $v_{max} \sim h/md$ (m = mass of e molecule h = Planck's constant). It is shown that n excitation energy appears in the quantum mechanical perturbation theory of an ideal gas when a small repulsive force is introduced between the molecules. G. L. W.

536.48 : 536.7 ≒ 4 3515

On the thermodynamics of the fountain effect in helium II and its inverse. DE GROOT, S. R. *C.R. Acad. Sci., Paris*, **225**, 173–5 (*July* 21, 1947) *In French.*—The validity of London's thermodynamical treatment is questioned, as this treats the phenomena as reversible. The application of Onsager's relations [Abstr. 2364 (1931), 1674 (1932)] for an irreversible process gives an alternative derivation of London's result. F. E. H.

536.48 : 538.222 *see Abstr.* 3578

536.48 : 539.155.2 *see Abstr.* 3614

536.53 3516

Determination of the thermal correction for a single-shielded thermocouple. ROHSENOW, W. M., AND HUNSAKER, J. P. *Trans. Amer. Soc. Mech. Engrs*, **69**, 699–704 (*Aug.*, 1947).—A single-shielded thermocouple has been developed for measuring the temp. of a hot gas stream which, while entirely practical, requires a thermal correction when being applied. A rapid graphical method of determining this correction and its magnitude in relation to some thermocouple designs is outlined. A.

536.581 : 621.316.74 3517

Continuous control thermoregulator. WRIGHT, P. *J. Sci. Instrum.*, **24**, 258–60 (*Oct.*, 1947).—Conditions determining constancy of furnace temp. are discussed, and it is pointed out that the effectiveness of a thermostat should be assessed by comparing the temp. fluctuations of the uncontrolled furnace with those of the controlled furnace. A continuous control thermoregulator of the photocell-thyratron type in which the controlling influence is applied through a saturated choke is described. Records obtained with different furnaces show that variations in supply voltage are mainly responsible for fluctuations, and that the thermoregulator reduces these fluctuations by a factor of 100. A.

536.581.3 : 621.383.2–71 3518

Refrigerator for a multiplier photo-tube. ENGSTROM, R. W. *Rev. Sci. Instrum.*, **18**, 587–8 (*Oct.*, 1947).

536.62 3519

Enthalpy, specific heat, and entropy of aluminum oxide from 0° to 900°C. GINNINGS, D. C., AND CORRUCCINI, R. J. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 593–600 (*June*, 1947).—Apparatus consisting of a furnace and ice calorimeter has been used for the measurement of enthalpies at high temperatures by the "drop" method. The enthalpy (referred to 0°C) of a sample of aluminum oxide (corundum) has been determined in the range 0° to 900°C. Derived values of specific heat and entropy are given. It is intended to use the corundum as a standard of heat capacity in substitution calorimetry. A.

536.62.088 3520

On a method of correcting for incomplete thermal isolation in measurements of small heat capacities. ASTON, J. G., AND SZASZ, G. J. *J. Chem. Phys.*, **15**, 560–1 (*Aug.*, 1947).—The treatment originally given by Keesom and Kok [Abstr. 5093 (1932)] is simplified in such a manner as to make it applicable to heat-capacity measurements in which the temp. of the system is known only before and after heating. A.

536.622 : 531.754 3521

An improved ice calorimeter—the determination of its calibration factor and the density of ice at 0°C. GINNINGS, D. C., AND CORRUCCINI, R. J. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 583–92 (*June*, 1947).—An improved Bunsen ice calorimeter has been constructed for measurements

of enthalpy at high temp. by the "drop" method. The calibration factor has been determined electrically to be 270·37 ± 0·06 international joules/g of Hg. Using this calibration factor, it is calculated that the density of ice at N.T.P. is 0·91671 ± 0·00005 g/ml. A.

536.63 : 532.122 : 536.48 = 5 *see Abstr.* 3513

536.63 + 536.656 + 536.424 3522

Thermal properties of cyclopentane and its use as a standard substance in low temperature thermal measurements. Szasz, G. J., Morrison, J. A., Pace, E. L., and Aston, J. G. *J. Chem. Phys.*, **15**, 562–4 (*Aug.*, 1947).

536.63 + 539.23 : 536.48 *see Abstr.* 3514

536.633.1 3523

The heat capacity of benzene vapor. The contribution of anharmonicity. Scott, D. W., Waddington, G., Smith, J. C., and Huffman, H. M. *J. Chem. Phys.*, **15**, 565–8 (*Aug.*, 1947).—The heat capacity of benzene vapour was measured at two or more pressures at each of five temps. in the range 68° to 198°C; and values of C_p°, the heat capacity in the ideal gas state, were obtained. By assuming a moderate degree of anharmonicity of the vibrations, it was possible to obtain excellent agreement between values of C_p° calculated statistically from spectroscopic data, and the observed values. An empirical equation for the second virial coefficient of benzene vapour was obtained from the observed values of $(\partial C_p/\partial P)_T$, and heat of vaporization and vapour pressure data. A.

536.656 + 536.424 + 536.63 *see Abstr.* 3522

THERMODYNAMICS 536.7

536.7 3524

The thermodynamic properties of water substance 0° to 150°C. VI. Keyes, F. G. *J. Chem. Phys.*, **15**, 602–12 (*Aug.*, 1947).—Correlation of all new data using Beattie's determinations of the relation of the International temperature scale of 1927 to the thermodynamic scale discloses a high degree of thermodynamic consistency from 0° to 150°C between thermal data, vapour pressures, and equation of state information. The proposed vapour pressures over the temperature range are probably accurate to ± 0·002°C. Tables of vapour pressure, pressure-temp. derivatives, essential temp.-scale magnitudes, enthalpies, and entropies are given. An equation of state for steam is reported from 0° to 460°C, valid for low pressures and based on the ensemble of volume data and enthalpy pressure coefficients available. A.

536.7 : 519.4 3525

A thermodynamical substitution group. Prins, J. A. *Physica, 's Grav.*, **13**, 417–21 (*Aug.*, 1947).—A mathematical paper dealing with the application of group theory to thermodynamics. F. E. H.

536.7 : 536.48 = 4 *see Abstr.* 3515

536.71 = 4 3526

The value of the exponent of the volume in the characteristic equation of fluids. Mezger, E. *C.R. Acad. Sci., Paris*, **225**, 175–6 (*July* 21, 1947) *In French.*—Writing the equation of state in the form $(p + a/v^\alpha)(v - b) = RT$, the value of α is sought from the conditions $dp/dv = 0$ and $d^2p/dv^2 = 0$ at the critical point. The three equations thus obtained allow α to be found in terms of the critical pressure, volume and temp. Examination of the data for a variety of substances shows the value of α to be $\sim 5/3$; the maximum variation for the substances listed is 8% high for Ne and 10·6% low for MeOH. F. E. H.

ELECTRICITY 537

537.1 : 530.12 *see Abstr.* 3419

537.122 : 530.14 *see Abstr.* 3423

537.122 : 538.3 = 4 35

The electron and the electromagnetic theory. Darrieu G. *Bull. Soc. Franç. Élect.* (*Sér.* 6) **7**, 249–64 (*May*, 194 *In French.*—A review of the non-linear classical electr dynamics developed by the author as a modification the Born–Infeld theory. L.

537.226.1 : 548.0 = 3 35

The ferro-electric lattice of the KH_2PO_4 type and t behaviour of the NH_4 rotation transformation $(NH_4, Tl)H_2PO_4$, solid solutions. Matthias, B., Mer W., and Scherrer, P. *Helv. Phys. Acta*, **20** (*No.* 273–306 (1947) *In German.*—All salts of the ty $(X,Y)H_2ZO_4$ isomorphous with KH_2PO_4 that it h been possible to prepare show ferro-electric propertie where Z is P or As and X and Y are K, NH_4, Rb, Cs, T Salts of this composition not isomorphous with KH_2PO are not ferro-eelctric. Crystals of the NH_4 salt a anomalous, in that they are shattered by a rotatic transformation at $T_\lambda \sim 147°$K; the permittivity || to drops from ~ 100 to ~ 10 and || to c from ~ 25 to $\sim$ at the same temp. As the NH_4 is replaced by Tl, T_λ drop nearly linearly to $\sim 92°$ for 20% Tl, passes through min. at 25% Tl, and increases to $\sim 105°$ at 35% T Crystals with $> 35\%$ Tl are not isomorphous wi KH_2PO_4. The violence of the transformation decreas with increasing Tl content, and crystals with $> 25\%$ T do not shatter and show merely a max. in the permittivit not a sudden drop. Curves are given of the permittivitie || to a and c and the resonance frequencies of cryst plates as a function of temp. and Tl content. Th resonance frequency shows a flat max. at a temp. i creasing regularly from 218°K for 0% Tl to 249° for 35 Tl. The piezo-electric modulus d_{36} shows an anomaly 25% Tl at room temp.; the modulus d_{14} shows only slight irregularity. The density shows a sudden increas at the same concentration. From the measurements a attempt is made to derive the force acting betwee NH_4^+ ions as a function of their distance apart. A. J. C. W

537.226.1 : 549.514.51 352

Dielectric constants of crystals. I. Different types quartz. Narayana Rao, D. A. A. S. *Proc. India Acad. Sci. A*, **26**, 408–12 (*May*, 1947).—A modifie method of determining the permittivity of a solid sub stance has been developed and applied to the measure ment of colourless quartz, smoky quartz, and amethys Different specimens of colourless quartz show slightl different values. Smoky quartz has the same value a colourless and its value is unaltered by decolorizatio Amethyst specimens have higher values than colourles specimens. W. R. A

537.228.1 : 536.424 353

Electromechanical properties of Rochelle salt at th lower Curie point. Lichtenstein, R. M. *Phys. Rev.*, 72 493–501 (*Sept.* 15, 1947).—The electrical characteristic of a.c. excited Rochelle salt crystals were measured a temps. near the lower Curie point, and the electro mechanical coefficients found from them are found to b related empirically to those of the upper Curie point The two points are the outcome of the same physica phenomenon: The (susceptibility)$^{-1}$ is given by th difference of two terms, one being slowly temp. dependent, and in Rochelle salt these are nearly equal A change of $\gtrsim 5\%$ in the interatomic restoring force of the lattice over a temp. range of 80° can produce al

remarkable electromechanical effects of Rochelle A.

228.5 : 535.33 *see Abstr.* 3467

291 : 537.534 *see Abstr.* 3557

ELECTRIC CURRENTS 537.3

311.1 : 621.3.014.1 : 621.385 3531

uctuations and electron inertia. BAKKER, C. J. ica, *'s Grav.*, **8**, 23–43 (*Jan.*, 1941).—[Abstr. 3099 B 7)].

311.1 : 621.385 = 3 3532

fethods for the compensation of different sorts of shot e in tubes and associated circuits. STRUTT, M. J. O., VAN DER ZIEL, A. *Physica, 's Grav.*, **8**, 1–23 (*Jan.*,) *In German.*—[Abstr. 3096 B (1947)].

311.1 : 621.385 = 3 3533

he consequences of some electron-inertia effects in tron tubes. STRUTT, M. J. O., AND VAN DER ZIEL, A. sica, *'s Grav.*, **8**, 81–108 (*Jan.*, 1941); **9**, 65–83 (*Jan.*, 2). *In German.*—[Abstr. 3097 B (1947)].

311.31.08 : 621.317.33.029.6 3534

onductivity of metallic surfaces at microwave fre- ncies. MAXWELL, E. *J. Appl. Phys.*, **18**, 629–37 y, 1947).—[Abstr. 3020 B (1947)].

311.33 : 537.311.4 3535

ensity of surface states on silicon deduced from contact ential measurements. BRATTAIN, W. H., AND SHOCK- , W. *Phys. Rev.*, **72**, 345 (*Aug.* 15, 1947).—Results tabulated showing the contact p.d. of *P*-type and ype Si against Pt for various concentrations of im- ities and treatments of the surface. The results are in eement with Bardeen's explanation of the surface es [Abstr. 2148 (1947)]. W. E. D.

311.33 : 537.311.4 3536

vidence for surface states on semiconductors from nge in contact potential on illumination. BRATTAIN, H. *Phys. Rev.*, **72**, 345 (*Aug.* 15, 1947).—Changes of tact p.d. on exposure to light were found in *P*-type l *N*-type Si and in *N*-type Ge at 120°K, consistent with rdeen's picture of the surface states [Abstr. 2148 47)]. W. E. D.

311.33 : 539.32 : 541.183.576 3537

ffect of polar vapours on the direct-current con- tance of keratin and nylon. KING, G., AND MEDLEY, A. *Nature, Lond.*, **160**, 438 (*Sept.* 27, 1947).—The rease of d.c. conductivity of nylon caused by adsorp- n of formic acid and water is shown on a graph; the mer has the greater effect, but the rate of increase gins to fall off in each case at an adsorbate conc. of moles/100 g. A similar turning point has been served for elastic moduli relations, and corresponds to uration of the available low-energy sites.

311.4 : 537.311.33 *see Abstr.* 3536–7

311.62 : 537.312.62.029.6 *see Abstr.* 3541–3

7.312.5 3538

The photo-conductivity of "incomplete phosphors." ERICHS, R. *Phys. Rev.*, **72**, 594–601 (*Oct.* 1, 1947).— nthetic single crystals of CdS, CdSe and CdTe have en produced by the reaction of Cd vapour with H_2S, H_2Se and H_2Te respectively. These "incomplete osphors" show no phosphorescence but strongly veloped photo-conductivity. Photo-cells made from ese crystals are extremely sensitive in the whole region om the infra-red to the ultraviolet, X-rays, and γ-rays d for corpuscular rays, α- and β-rays. Two different echanisms of photo-conductivity occur: the normal photo-conductivity in the region of strong absorption from the blue to the ultraviolet, and the selective photo-conductivity in the region of weak absorption in the visible, X-rays and corpuscular-rays region. The phenomena observed are in general accordance with the zonal theory of phosphorescence. A.

537.312.5 : 541.135.85 *see Abstr.* 3707

537.312.5 : 77.011 3539

Photo-conductivity in photographic systems. I. Dye-sensitization of photo-conductivity. WEST, W., AND CARROLL, B. H. *J. Chem. Phys.*, **15**, 529–39 (*Aug.*, 1947).—Measurements of photo-conductivity of gelatine/Ag halide photographic films are reported, which show that the effect is closely parallel (spectral sensitivity, sensitization by dyes) to the photographic process, and can be ascribed to the same cause. The photo-current $\propto$ applied field up to > 140 V/mm, and $\propto$ light intensity within the photographic range; above this, it tends to (intensity)$^{\frac{1}{2}}$, and this is interpreted to indicate that recombination of photo-electrons with Br atoms, instead of capture by traps, begins to predominate. A sensitizing dye acts by passing on absorbed energy to liberate an electron within the conduction band of the halide. A.

II. Some applications to the phenomena of super-sensitization, desensitization, and the Becquerel effect. *Ibid.*, 539–43 (*Aug.*, 1947).—Studies of the photo-conduction of photographic films afford a means of discriminating between photographic effects originating in effects on the primary liberation of electrons and those due to actions effective at later stages in image formation. For example, the photographic action of certain super-sensitizers in increasing the sensitizing effect of dyes of the 2,2'-cyanine class has its counterpart in a supersensitized photo-conductivity, showing that the supersensitizer influences the efficiency of the primary transfer of energy (or of an electron) from the sensitizing dye to the halide. On the other hand, photographically desensitizing dyes have only secondary effects on photoconductivity, showing that their action is not essentially to inhibit the photo-liberation of electrons. The photographic Becquerel effect—the conferring of sensitivity to light of wavelengths longer than those absorbed by the silver halide by the presence in the film of photolytic silver—has an analogue in photo-conductivity. A.

537.312.6 + 537.323 3540

Resistance-temperature relation and thermoelectric properties of uranium. DAHL, A. I., AND VAN DUSEN, M. S. *J. Res. Nat. Bur. Stand., Wash.*, **39**, 53–8 (*July*, 1947).—The resistance-temp. relation showed sharp breaks at $\sim 650°$ and 770°C, indicating the existence of transformation points. The change occurred somewhat higher on heating than on cooling. Only slight irregularities in the thermo-electric properties were noted in the region of the transformation points. A.

537.312.62 : 538.12 *see Abstr.* 3572

537.312.62.029.6 : 537.311.62 3541

The surface impedance of superconductors and normal metals at high frequencies. I. Resistance of superconducting tin and mercury at 1 200 Mcyc./sec. PIPPARD, A. B. *Proc. Roy. Soc. A*, **191**, 370–84 (*Nov.* 18, 1947).—The technique of resonator measurements at 1 200 Mc/s is described in detail, and experimental curves are given showing the variation with temp. of the r.f. resistivities of superconducting Sn and Hg. In contrast to the behaviour of superconductors in static fields, a finite resistance is present at all temps., tending as the absolute zero is approached to a very low value,

which is probably zero for Hg but not for Sn. The experimental results are in good agreement with London's measurements on Sn by a different method. The latter's observation, that the r.f. resistance of normal Sn above the transition point ≫ that predicted from the classical skin-effect theory, is confirmed, and a similar, though less marked, effect is found also for Hg. A.

537.312.62.029.6 : 537.311.62 3542

The surface impedance of superconductors and normal metals at high frequencies. II. The anomalous skin effect in normal metals. PIPPARD, A. B. *Proc. Roy. Soc. A*, **191**, 385–99 (*Nov.* 18, 1947).—Measurements on the skin conductivity of the normal metals Ag, Au and Sn show that at low temps. the skin conductivity tends to become independent of the d.c. conductivity, which is at variance with the predictions of classical skin-effect theory. Following a suggestion of H. London that this anomalous behaviour is due to the mean free path of the electrons becoming ≫ the skin depth [Abstr. 137 (1941)], an attempt is made to calculate the effect for a semi-classical model of a metal. Although a rigorous solution has not been found, it is shown that the model predicts constancy of skin conductivity when the mean free path becomes very long. Moreover, there is reason to suppose that under these conditions only a small proportion of the conduction electrons contribute effectively to the h.f. current, and an exact solution is given for a model based on this concept, which also predicts that the skin conductivity should be independent of the d.c. conductivity. A simple dimensional argument may be applied to enable values of the mean free path in Cu, Au, Al, and Sn, relative to the value in Ag, to be deduced from the experimental results. These values are not in good agreement with theoretical estimates by Mott and Jones. The behaviour of Hg is different from that of the other metals investigated, in that the skin conductivity does not tend to a constant value. It is suggested that the theory based on a crude classical model is inapplicable to a metal such as Hg, in which the anomalous skin effect appears at such temps. that the ideal resistance is still ≫ the residual resistance. A.

537.312.62.029.6 : 537.311.62 3543

The surface impedance of superconductors and normal metals at high frequencies. III. The relation between impedance and superconducting penetration depth. PIPPARD, A. B. *Proc. Roy. Soc. A*, **191**, 399–415 (*Nov.* 18, 1947).—The theory developed in II is extended to cover the case of a superconductor, and a formula is derived relating the r.f. resistivity to the superconducting penetration depth and other parameters of the metal. It is shown how the penetration depth may be deduced directly from measurements of the skin reactance, and a method of measuring reactance is described, based essentially on the variation of the velocity of propagation along a transmission line due to the reactance of the conductors. For technical reasons it is not convenient to measure the reactance absolutely, but a simple extension of the technique described in I enables the change in reactance to be accurately measured when superconductivity is destroyed by a magnetic field. The method has been applied to Hg and Sn. In the former case the results are in agreement with Shoenberg's direct measurements, and confirm that the penetration depth at 0°K is $\sim 7 \times 10^{-6}$ cm. The theory is used to deduce the variation of penetration depth with temp. from the resistivity measurements of I, and it is shown that agreement with other determinations and with the reactance measurements is fairly good, but not perfect. Some of the assumptions used in developing the theory are critically discussed, and a qualitative account is given to show how Heisenberg's theory of superconductivity offers an explanation of some of the salient features of superconductivity, and in particular indicates the relation between superconducting and normal electrons.

537.322.2 : 621.316.3.066.6 = 3 35

Determination of Thomson coefficients. EKKERS, G. J. AND FARNER, A. *Helv. Phys. Acta*, **20** (*No.* 3) 250- (1947) *In German.*—For W the Thomson effect is 0 $\sim$ 1 400°c. Below this temp. the effect is increasing positive and above it increasingly negative. This resu is applied to the explanation of the transport of met from anode to cathode in switch contacts where there no sparking. A. J.

537.323 + 537.312.6 *see Abstr.* 3540

537.363 35

Electrophoresis. WIEDEMANN, E. *Experientia*, **3** (*No.* 341–53 (1947).—A general review of the foundations ar modern development of electrophoresis (92 references).

ELECTRIC DISCHARGES AND RADIATIONS 537

537.523.4 35

An attempt to verify the theory of the long spark Loeb and Meek. FISHER, L. H. *Phys. Rev.*, **72**, 423- (*Sept.* 1, 1947).—D.c. sparking potentials in a plan parallel gap in air have been measured as a function plate separation and pressure. Below atmospher pressure, the sparking-potential curve as a function of ga length displayed a peculiar levelling-off at large ga lengths, due to field distortion, caused by the walls of th large chamber used. This prevented the verification the Loeb–Meek theory. Meek's equation represents th data accurately at atmospheric pressure. Water vapo caused a small but definite scattering in sparki potentials.

537.523.5 = 3 35

Calculation of the chemical equilibrium and temperatu ionization of air in the electric arc. HULDT, L. *Ar. Mat. Astr. Fys.*, **34 A** (*Paper* 30) 9 *pp.* (1947) *In German.*— The application of Saha's equation to arcs [see Abst 1647 (1923)] enables the partial electron, ion and mol cular pressures to be calculated. This is done for arcs air where p_{N_2}, p_N, p_{O_2}, p_O, p_{NO}, p_{e^-}, p_{NO^+}, p_{O^+} and p_{N^+} are found, and the results are compared with earli work [see Abstr. 4527 (1932)]. J. D.

537.525 35

Influence of the applied potential on the Joshi effec PRASAD, B. N., AND JAIN, T. C. *Proc. Indian Aca Sci. A*, **26**, 515–19 (*June*, 1947).—The distribution of th total current, i, as i_{aerial}, which represents the highe (mean) frequency, i_{HF} and i_{LF}, the filtered high and lo frequency parts of the tube current in the LT line, ha been studied in dark and in light at applied potentia between 5 and 9 kV. The relative Joshi effect, $\%\Delta$ varies thus: $i_{aerial} > i_{HF} > i_{LT} > i_{LF}$, i.e. in order the mean frequencies. The "threshold potential," V_m, is independent of the nature of the detectors and the frequency region. $\%\Delta i$ is a max. near V_m. Whe the applied potential is increased $\%\Delta i$ decreases owin possibly, to the corresponding preponderance of i_{LF} whic is comparatively insensitive to the production of th phenomenon. W. R.

537.525.3 = 3 354

Concerning the formation time, reaction mechanis and stability of low-current, low-pressure discharge VON GUGELBERG, H. L. *Helv. Phys. Acta*, **20** (*No.* 307–40 (1947) *In German.*—The general properties

discharges in the region between Townsend and glow charges are described ($pd < 100$ mm cms, current ^{11}–10^{-4} A). Formative times and γ mechanisms hode effects, photo-ionization, diffusion of metastable ns, etc.) are discussed. The discharges have technical ificance. J. D. C.

.525.72 3550

he effect of a direct current potential on the initiation radiofrequency discharge. KIRCHNER, F. *Phys. Rev.*, 348 (*Aug.* 15, 1947).—See Abstr. 1221 (1947). The sent writer points to similar earlier results of his bstr. 2569 (1925)]. W. E. D.

.531 : 535.313 3551

-ray optics. EHRENBERG, W. *Nature, Lond.*, **160,** -1 (*Sept.* 6, 1947).—A fairly good line image of a line rce (slit) has been obtained by glancing reflection n a gilded glass plate bent by application of a symrical pair of couples; object-image distance $\simeq 35$ cm, *K* radiation. Interferences arising from spacings of 05 mm should thus be resolved.

.531 : 539.163.2 *see Abstr.* 3632

.531 : 614.898.5 : 621–784.3 3552

telative thickness of lead, concrete, and steel required protection against narrow beams of X-rays. SINGER, WYCKOFF, H. O., AND DAY, F. H. *J. Res. Nat. . Stand., Wash.*, **38,** 665–72 (*June*, 1947).—The Pb iivalents of X-ray protective barriers are given for h concrete and steel for potentials between 200 and 00 kV. These were determined experimentally using ressure ionization chamber and narrow X-ray beams. e data obtained are compared with those published other workers. Data on the relative masses referred Pb of both concrete and steel barriers are included. reement is satisfactory. A.

.533.7 : 621.385.83 3553

Electron beam deflection. I. Small-angle deflection ory. II. Applications of the small-angle deflection ory. HUTTER, R. G. E. *J. Appl. Phys.*, **18,** 740–58 g.); 797–810 (*Sept.*, 1947).—[Abstr. 3119 B (1947)].

.533.72 : 621.385.833 3554

Coaxial electron lenses. DUNGEY, J. W., AND HULL, R. *Proc. Phys. Soc., Lond.*, **59,** 828–43 (*Sept.*, 1947).—bstr. 3125 B (1947)].

.533.74 3555

Multiple scattering of electrons in the gas of a Wilson ud chamber. SMITH, L. W., AND KRUGER, P. G. *ys. Rev.*, **72,** 357–9 (*Sept.* 1, 1947).—The deviation m linearity of straight electron tracks appearing in a ud chamber has been measured and found to be in reement with that predicted by the theory of multiple ttering insofar as the energy of the electrons is known. e method described could be easily modified to give a re valuable and exact check on the theory of multiple ttering. A.

.533.9 3556

Particle "growth" in the electron microscope. COSLETT, E. *J. Appl. Phys.*, **18,** 844–5 (*Sept.*, 1947).—Similar wth in particle size to that noticed by Watson [Abstr. 1 (1947)] was observed with oxides of Zn, Mo and . The effect is believed to be due to ejection of orbed matter, and perhaps of metal itself, from the d wires under electron bombardment. Several photoaphs are shown.

.534 : 537.291 3557

Electrostatic analyzer for selection of homogeneous beam. WARREN, R. E., POWELL, J. L., AND HERB, G. *Rev. Sci. Instrum.*, **18,** 559–63 (*Aug.*, 1947).—An ctrostatic analyser has been built for use with the high pressure electrostatic generator at the University of Wisconsin. The proton beam from the generator is deflected through a 90° arc of 40-in radius by means of a radial electric field between curved metal plates spaced $\frac{5}{16}$ in apart. Suitably disposed slits select a beam which has a 0·1% energy spread. The apparatus has been operated with energy resolutions up to 5 000, and preliminary tests have been made, using the 985 and 1 020 kV γ-ray resonances in the reaction $Al^{27} + H^1 \rightarrow Si^{28} + h\nu$. A.

537.534 : 621.384.6 : 539.172.1 *see Abstr.* 3646

537.54 3558

Localisation of the discharge tubes. II. CHIPLONKAR, V. T. *Proc. Indian Acad. Sci. A*, **26,** 453–8 (*May*, 1947).—Localization in discharge tubes is uninfluenced by the nature of the gas in the tube but depends markedly on the dimensions of the tube, being most pronounced in narrow tubes. When the length of the cathode dark space is small the form of the radial distribution of the current density on the cathode surface is greatly modified. W. R. A.

537.542 3559

On the rise of the wire-potential in counters. KORFF, S. A. *Phys. Rev.*, **72,** 477–81 (*Sept.* 15, 1947).—The rate at which the potential of the central wire in a counter changes when a count takes place is considered. The electron collection-time is found to be between 1 and 3×10^{-8} sec. The subsequent variations in potential are controlled by the motion of the positive ions. Some experiments are reported, in which rises of 100 V/μsec were observed. The factors controlling fast counting are briefly discussed. A.

537.542 3560

The discharge mechanism of self-quenching Geiger–Mueller counters. LIEBSON, S. H. *Phys. Rev.*, **72,** 602–8 (*Oct.* 1, 1947).—A split counter arrangement was used to investigate the absorption coefficient of the radiation which causes the discharge to spread along the wire of a counter after the triggering of a pulse. The counters used were filled with methylene bromide and A at various pressures, and with EtOH and A. The results indicate that the vapour dissipates electron energies, thereby reducing the number of photons produced during the discharge. It was also observed that the absorption coefficient is a function of the A alone, from which it was concluded that photo-ionization of the A is responsible for spreading the discharge along the wire. This behaviour was also observed with He and Ne in combination with alcohol or methylene bromide. A.

537.542 3561

Design of metal G-M counters. SHAMOS, M. H. *Rev. Sci. Instrum.*, **18,** 586–7 (*Oct.*, 1947).

537.542 : 535.33.03 *see Abstr.* 3469

537.542 : 539.166.08 = 4 *see Abstr.* 3639

537.542 : 621.314.69 = 5 3562

New rectifying effect in discharge tubes. LOVERA, G., AND POCHETTINO, A. *Nuovo Cim.*, **1,** 354–62 (*Aug.*, 1943) *In Italian.*—In symmetrical discharge tubes fed with alternating potentials, a total rectification of the current occurs at certain potentials when a difference of gas pressure is maintained between the electrodes. An explanation is given in terms of the discharge characteristic. F. L. J.

537.56 : 539.16.08 *see Abstr.* 3619

537.56 : 539.164.92 = 4 3563

Energy of ionization, recombination effects and stopping power for α-particles in various gases. DICK, L., FALK-VAIRANT, P., AND ROSSEL, J. *Helv. Phys. Acta.*

20 (*No.* 3) 357–72 (1947) *In French.*—Using a parallel plate ionization chamber and linear amplifier, measurements were made of the ionization produced by Th(C + C′) α-particles in N_2, O_2, Cl_2, CO_2, BF_3, CH_4 and CF_4 at pressures between 2 and 40 atmos. Saturation curves of pulse size v. collecting voltage are given for all pressures. Values of stopping power and energy per ion pair are compared with those given in the International Critical Tables and show good agreement for the most part. A. P. F.

537.561 = 3 3564

Determination of ionization work of nitrogen and air with Po α-particles. ALDER, F., HUBER, P., AND METZGER, F. *Helv. Phys. Acta*, **20** (*No.* 3) 234–5 (1947) *In German.*—The values $36{\cdot}3 \pm 0{\cdot}4$ and $34{\cdot}7 \pm 0{\cdot}5$ eV, respectively, were obtained using an ionization chamber and linear amplifier. It is sometimes desirable to use U as a standard instead of Po. Assuming that the ionization work for the α-energies of Po, U^{234}, and U^{238} are the same, the α-energy of U^{234} is $4{\cdot}78 \pm 0{\cdot}03$ MeV and that of U^{238} is $4{\cdot}18 \pm 0{\cdot}03$ MeV. A. J. M.

537.561 : 539.155.2 *see Abstr.* 3615

COSMIC RAYS 537.591

537.591 : 539.18 *see Abstr.* 3662

537.591.08 : 539.16.08 : 621.318.572 3565

Electronics for cosmic-ray experiments. HOWLAND, B., SCHROEDER, C. A., AND SHIPMAN, J. D., JR. *Rev. Sci. Instrum.*, **18**, 551–6 (*Aug.*, 1947).—[Abstr. 3075 B (1947)].

537.591.15 3566

Theoretical evaluation of the size-frequency curve of extensive cosmic-ray showers. COCCONI, G. *Phys. Rev.*, **72**, 350–1 (*Aug.* 15, 1947).—It has been stated [Abstr. 1560 (1947)] that recent results on extensive showers are inconsistent with the cascade theory. The present letter shows this deduction to be incorrect and points out the error made by the previous workers. W. E. D.

537.591.15 3567

Altitude dependence of high energy atmospheric showers. KRAYBILL, H. L., AND OVREBO, P. J. *Phys. Rev.*, **72**, 351 (*Aug.* 15, 1947).—Triple coincidences between two close counters and a third displaced 11 ft in a horizontal direction were measured at various heights. The number rose rapidly up to 25 000 ft and remained const. thereafter up to 33 000 ft. These showers showed no latitude effect at 33 000 ft, the counting rate being the same between 0° and 25°N geomagnetic as between 48° and 51°N. W. E. D.

537.591.15 3568

Observations underground of penetrating cosmic ray showers. GEORGE, E. P., AND JASON, A. C. *Nature, Lond.*, **160**, 327–8 (*Sept.* 6, 1947).—No showers capable of penetrating 15 cm of Pb were recorded by a coincidence counter arrangement under 100 ft of clay in 45 days. The shower-producing layer was 5 cm of Pb, which produces 0·4 coincidences/hour at sea level. Bursts of >20 rays under 7 cm of Pb were recorded in a small ionization chamber filled with A at 40 atmos, but in 100 days none of these coincided with rays capable of passing 15 cm of Pb [see Abstr. 907 (1947)]. The sea level/underground ratio of bursts under 7 cm of Pb was 16—unexpectedly low.

537.591.3 = 3 3569

Absorption of cosmic rays by the photographic emulsion method. I. Disintegration stars under a lead absorber. STETTER, G., AND WAMBACHER, H. *S.B. Akad. Wiss. Wien*, **152**, *Abt. IIa* (*Nos* 1–5) 1–6 (1944) *In German.*—Plates were simultaneously exposed at 2 300 m with an without a 10 cm Pb absorbing layer. No significar difference either of number of stars or of single track was found, but the energy distribution in stars ma indicate a slight shift towards lower energies. J. G. W.

537.591.8 : 523.51 *see Abstr.* 3409

537.591.8 : 539.172 *see Abstr.* 3645

MAGNETISM 538

538.114 357

Probabilities of magnetization. RICHER, G. C. *Natur Lond.*, **160**, 256 (*Aug.* 23, 1947).—In order to explai discrepancies between estimates of grain orientation c polycrystalline Fe made from analysis of magnetizatio curves and from directional measurements of Young modulus, a hypothesis is advanced that the 180° revers component of the steep part of the curve represents th summation of 3 probability integrals, one for each of th idealized [100], [110] and [111] crystal groups. Th hypothesis is able to give a satisfactory account o observed results [Abstr. 1575 (1947)].

538.114 = 393 357

The decrease of permeability with increasing frequenc VAN LEEUWEN, H. J. *Physica, 's Grav.*, **11**, 35–42 (*Jan* 1944) *In Dutch.*—The value of the currents induced b domain boundary movement, as calculated by Becke and Döring, is too large to permit of the high boundar speeds measured by Sixtus and Tonks [Abstr. 76 (1933)]. An explanation is offered by assuming that th boundary is not plane, the critical freq. for permeabilit diminution remaining of the same order as calc. by Becke and Döring, however, if a larger domain size is assume Confirmation is obtained from the Barkhausen measur ments of Bozorth and Dillinger [Abstr. 3243 (1930)]. G. F. J.

538.12 : 537.312.62 35

A floating magnet. ARKADIEV, V. *Nature, Lond.*, **16** 330 (*Sept.* 6, 1947).—Equilibrium between diamagnet repulsive and gravitational attractive forces is possibl thus a magnet would be in equilibrium 1 cm away fro a Cu sphere of ~20 m dia. For a sphere of the size the earth, a very strong diamagnetic would be neede but a super-conductor can effectively balance the earth gravitational force. This is illustrated by a photograp of a magnet $4 \times 4 \times 10$ mm floating above a concave supe conducting Pb disc.

538.213 : 621.3.013 35

Vector permeability. MACFADYEN, K. A. *J. Ins Elect. Engrs, Pt III*, **94**, 407–14 (*Nov.*, 1947).—[Abst 2925 B (1947)].

538.213 : 621.318.042.15 35

Permeability of dust cores. LAMSON, H. W. *Wirele Engr*, **24**, 267–70 (*Sept.*, 1947).—[Abstr. 3058 B (1947)

538.22 35

The structure of ozone—an interpretation of its magnet susceptibility. ANANTAKRISHNAN, S. V. *Proc. Indi Acad. Sci. A*, **26**, 520–2 (*June*, 1947).—By assuming th O–O and O=O bond depressions differ from N–N ar N=N bond depressions by exactly the same amounts are found between C–C and N–N and C=C and N=1 values for the magnetic susceptibility of various reso ance structures of O_3 are computed. They indicat contrary to experimental observation, that O_3 is di magnetic $\sim -18 \times 10^{-6}$. Possible causes for t discrepancy are considered. W. R.

538.221 35

Oscillations of elementary magnets. ARKADIEW, *Nature, Lond.*, **160**, 397 (*Sept.* 20, 1947).—Curves a

n for the magnetic properties of Ni wires and Fe_2O_3 ders at cm wavelengths, based on the author's ries of elastic-viscous rotation of magnetic dipoles a moment of inertia. It is shown that the results of s [Abstr. 385 (1947)] agree with the form of the r, and indicate the existence of 3 groups of molecular nets.

221 : 621.317.41.029.64 3577

igh-frequency permeability of ferromagnetic materials. HOLZ, G., AND HODSMAN, G. F. *Nature, Lond.*, **160**, 3 (*Aug.* 30, 1947).—The permeability was measured bserving the change in attenuation of a coaxial line n the centre conductor was changed from a non- to ro-magnetic material. Results for the range 2 300–) Mc/s are reported.

222 : 536.48 3578

rther researches on paramagnetic absorption in mium potassium alum. DIJKSTRA, L. J., GORTER, . AND VAN PAEMEL, O. *Physica, 's Grav.*, **9**, 673–85 *v*, 1942).—New measurements on paramagnetic rption at liquid air temp. in parallel and perpen- lar static magnetic fields are reported. The results be fitted to a plausible formula, but the theoretical rpretation is not completely satisfactory. D. S.

222 : 538.224 = 3 3579

ara- and dia-magnetic nickel compounds. IV. CHITZ, I. *Rec. Trav. Chim. Pay-Bas*, **66**, 401–6 *e*, 1947) *In German.*—The magnetic susceptibility of rmylethylenediimincamphor nickel in the solid state in different solvents has been measured by a Curie– neveau balance. The solid is diamagnetic, and in tions of C_6H_6 and $COMe_2$ it is also diamagnetic, reas in MeOH, $PhNO_2$ and MeCN it is paramagnetic. rotation dispersions of its solutions in C_6H_6 and OH have been measured. Relationships between ation dispersion and molecular configuration are sidered. W. R. A.

224 : 538.222 = 3 *see Abstr.* 3579

224 : 541.67 3580

tructure and diamagnetic susceptibility of cyclo-tetraene. PINK, R. C., AND UBBELOHDE, A. R. *ture, Lond.*, **160**, 502 (*Oct.* 11, 1947).—The molecular ceptibility of the liquid at 20°c has been measured as $51{\cdot}9 \times 10^{-6}$ indicating a structure composed of a lic system of conjugated double and single bonds, l not of an "aromatic" pool of electrons.

ELECTROMAGNETISM
ELECTRODYNAMICS 538.3/.5

3 = 4 3581

An approximate expression of the normal component of Maxwell tensor as a function of the Poynting vector. MBLET, J. *Physica, 's Grav.*, **13**, 17–20 (*March*, 7) *In French.*—The normal component of the xwell tensor is proved to be equal, apart from negli- le terms, to $-S/c$, S being the Poynting vector. m this relation it is possible to show in a general y that not only e.m. energy and momentum, but also . moment of momentum propagates in vacuo with ocity c. L. P.

3 : 530.145 *see Abstr.* 3426

3 : 537.122 = 4 *see Abstr.* 3527

3.311 : 621.318.4 3582

The production of a uniform magnetic field over a ecific volume by means of twin conducting circular coils. AIG, H. *Proc. Phys. Soc., Lond.*, **59**, 804–14 (*Sept.*, 47).—[Abstr. 3064 B (1947)].

538.566 = 3 3583

The mechanism of electromagnetic waves. I. Plane waves. FLAMM, L. *S.B. Akad Wiss. Wien*, **154**, *Abt. IIa* (*Nos* 1–10) 1–17 (1945) *In German.*—Starting from geometrical and mechanical properties of the electric field of an elementary charge, and with a suitable definition of the magnetic field, a mechanical foundation is provided for the electromagnetic equations, applying to the case of a plane wave. L. P.

538.566 = 3 3584

The mechanism of electromagnetic waves. II. Spherical waves. FLAMM, L. *S.B. Akad. Wiss. Wien*, **154**, *Abt. IIa* (*Nos* 1–10) 18–49 (1945) *In German.*—The considerations of the previous part are extended to spherical waves. L. P.

538.566 : 621.392.2 = 5 3585

The theory of Lecher wires. MATEROSSI, T. M. *Nuovo Cim.*, **1**, 190–204 (*June*, 1943) *In Italian.*—[Abstr. 3133 B (1947)].

538.569.2.047 : 577.088.75 = 4 *see Abstr.* 3751–2

MAGNETIC EFFECTS 538.6

538.61 = 5 3586

New magneto-optical experiments. MAJORANA, Q. *Nuovo Cim.*, **1**, 120–5 (*April*, 1943) *In Italian.*—Describes the application of a vacuum photocell and amplifier to the observation of the Kerr and Faraday effects. Attention is drawn to the contribution made by the Faraday effect in the surface layer of air over the pole tip giving the Kerr effect, and the conclusion is drawn that non-ferromagnetics do not show a true Kerr effect. N. F. A.

538.61 : 548.0 3587

Faraday effect in some cubic crystals. RAMASESHAN, S. *Proc. Indian Acad. Sci. A*, **26**, 459–66 (*May*, 1947).—Verdet constants, refractive indices, dispersion and magneto-optical anomaly have been determined for 5 893, 5 461 and 4 358 Å for NaCl, KCl, CaF_2, LiF, KBr, NH_4Cl, NH_4Br and MgO. W. R. A.

538.614 3588

Determination of the magneto-optic rotatory power of pure organic substances and their mixtures. BROERSMA, S., WATERMAN, H. I., WESTERDIJK, J. B., AND WIERSMA, E. C. *Physica, 's Grav.*, **10**, 97–129 (*March*, 1943).—An apparatus for measuring Verdet's constant, V, absolutely with an accuracy within 1% is described and the values for a long series of organic compounds are recorded. It is found that the magneto-optic rotation constant $D = 9nMV/(n^2 + 2)^2d$ (n = refr. index, M = mol. wt, d = density) is additive, being composed of contributions from the atoms or radicals together with structural contributions. With the exception of some complex structures, the additivity holds within 5%. In mixtures where no volume change is involved the rotation constants are also additive. The results are applied to the analysis of technical mixtures of hydrocarbons, and the method is claimed to be better than that based on parachors. C. B. A.

538.614 : 548.0 = 4 3589

Paramagnetic rotatory power of an almandin-pyrope garnet from Madagascar. BECQUEREL, J., AND VAN DEN HANDEL, J. *Commun. K. Onnes Lab. Leiden* (*No.* 259c). *Physica, 's Grav.*, **7**, 705–10 (*Oct.*, 1940) *In French.*—The paramagnetic rotations of the plane of polarization are given for the crystal which contains the paramagnetic ions $Fe^{\cdot\cdot}$ and $Fe^{\cdot\cdot\cdot}$. The influence of $Mn^{\cdot\cdot}$ and $Mn^{\cdot\cdot\cdot}$ on the results is discussed qualitatively. W. R. A.

538.614 : 548.0 = 4 3590

The magnetic rotatory power of an almandin-pyrope garnet. BECQUEREL, J. *Commun. K. Onnes Lab. Leiden* (*No.* 261*d*). *Physica, 's Grav.*, **7**, 945–60 (*Dec.*, 1940) *In French.*—The ^6S state of $Fe^{\cdots}$ in the mineral appears to be easily decomposed by the crystalline field. The interpretation in respect of $Fe^{\cdot\cdot}$ ions in the mineral is less certain, but at sufficiently low temps. the paramagnetic rotation due to $Fe^{\cdot\cdot}$ ions is proportional to the field and independent of temp. W. R. A.

538.615 : 535.33 = 4 *see Abstr.* 3468

538.615 : 535.343.2 = 3 *see Abstr.* 3474

ATOMIC AND MOLECULAR STRUCTURE 539

539 3591

Release of information on atomic energy. *Nature, Lond.*, **160**, 445 (*Sept.* 27, 1947).—The titles of 25 British papers recently released are listed.

539.11 : 519.2 *see Abstr.* 3405

539.13 3592

Restricted rotator thermodynamic properties from the old quantum theory. HALFORD, J. O. *J. Chem. Phys.*, **15**, 645–51 (*Sept.*, 1947).—Accurate partition functions and free energies are calculated for the hindered internal rotator from the old quantum theory based upon the quantization rule of Wilson and Sommerfeld. The description of the system is incomplete and the energy levels may even be incorrectly placed, but the partition functions are surprisingly close to those now accepted as correct. In the course of the development the lowest energy state of the harmonic oscillator turns up in its correct position at the half-quantum level. A.

539.13 : 535.343 *see Abstr.* 3473

539.132 = 3 3593

A simple approximation method for quantum-mechanical treatment of the π-electron system of aromatic hydrocarbons. HARTMANN, H. *Z. Naturforsch.*, **2a**, 259–62 (*May*, 1947) *In German.*—A method has been developed, which enables the exchange energy of the π-electrons in the ground state of aromatic hydrocarbons to be obtained, without the work of computation from the structural formula. The results are on the whole in agreement, and comparable in accuracy, with those derived by the Slater–Pauling process. In the cases of anthracene and phenanthrene, the results are superior to those obtained by the last-named method. Examples are included of determinations of exchange energies of π-electrons for whole classes of compounds, viz. of benzene and associated compounds such as naphthalene, anthracene, etc., polyphenyls, and complex ring systems such as coronene. H. H. HO.

539.132 = 3 3594

A quantum-mechanical approximation process for the treatment of the π-electron system of aromatic hydrocarbons. II. HARTMANN, H. *Z. Naturforsch.*, **2a**, 263–4 (*May*, 1947) *In German.*—The results for the energy of the π-electron systems of aromatic hydrocarbons, as calculated by the author's process [preceding abstract], are compared with the data obtained by the Hückel approximation process; very satisfactory agreement is found for 18 molecules examined. H. H. HO.

539.132 : 535.342 : 535.375.5 = 4 3595

Contributions to the study of the vibrations of long carbon chains. BARRIOL, J., AND CHAPELLE, J. *J. Phys. Radium* (*Sér.* 8) **8**, 8–13 (*Jan.*, 1947) *In French.*—The vibrations of a zig-zag chain have been calculated by taking account of valence forces and deformation angles. It is concluded that the corresponding frequenci interfere only faintly in diffusion spectra and in infra-r absorption. W. R.

539.133 35

The electric resonance method of radiofrequency spectr scopy. The moment of inertia and electric dipole mome of CsF. HUGHES, H. K. *Phys. Rev.*, **72**, 614–23 (*Oct.* 1947).—This paper describes the method of radi frequency spectroscopy in which transitions between tl energy levels of a single rotational state of a line rotator in an electric field are caused by a superimpos radiofrequency field [Abstr. 934 (1947)]. The meth has been applied to the measurement of the moment inertia, I, and the electric dipole moment, μ, of Cs Values for these quantities are: $I = (187 \pm 22)10^{-40}$ g cm and $\mu = 7{\cdot}3 \pm 0{\cdot}5$ Debye. The internuclear distanc derived from the moment of inertia, is $2{\cdot}60 \pm 0{\cdot}16$ Å.

539.133 = 5 35

Similitude of diatomic molecules. PUPPI, G. *Nuo Cim.*, **3**, 338–41 (*Oct.*, 1946) *In Italian.*—It is observe that the quantity $A = \mu\omega^2 r^2$ (μ = reduced mas ω = fundamental frequency; r = distance of equilibriur is sensibly constant for diatomic molecules of the san type (e.g. NaCl, NaBr, NaI). Hence an approxima expression is derived for the potential function. L.

539.133 : 535.343.4–15 *see Abstr.* 3481

539.133 : 539.152.2 : 535.343.4–14 35

Nuclear and molecular constants from microwa spectra: methyl chloride and methyl bromide. GORDY, W SIMMONS, J. W., AND SMITH, A. G. *Phys. Rev.*, **72**, 344 (*Aug.* 15, 1947).—From measurements on the rotation transition $J = 0$ to $J = 1$ for the chloride and on $J =$ to $J = 2$ for the bromide, the quadrupole coupling facto for Cl^{35}, Cl^{37}, Br^{79} and Br^{81} have been deduced. using Townes' method for estimating the value $\partial^2 V/\partial z^2$ [Abstr. 2615 (1947)], the quadrupole momer for these atoms were deduced. W. E.

539.133 : 548.7 : 535.343.2–15 = 4 *see Abstr.* 3476

539.152.1 35

Definition of nuclear quadrupole moments. RHODERIC E. H. *Nature, Lond.*, **160**, 255–6 (*Aug.* 23, 1947).—T exact meaning to be attributed to the word "average" the definition of quadrupole moments is discuss (i.e. average over all protons, or only over those n symmetrically arranged).

539.152.1 36

The nucleus as a crystalline solid. WINANS, J. *Phys. Rev.*, **72**, 435–6 (*Sept.* 1, 1947).—The criticis [Abstr. 2204 (1947)] that the crystalline solid concept the nucleus [Abstr. 1591 (1947)] would lead to differe charge-to-mass ratios of the two unequal fragments, contested on the grounds that observations are made a time sufficiently long after fission for rearrangement have taken place. An example of the detailed arrang ment of the nucleons is given to show that an unequ splitting would be expected. W. E.

539.152.1 36

Nuclear magnetic resonance at low temperature ROLLIN, B. V., HATTON, J., COOKE, A. H., AND BENZ R. J. *Nature, Lond.*, **160**, 436–7 (*Sept.* 27, 1947). Previous observations [Abstr. 941 (1947)] have be extended to liquid He temps. Variations with temp. the broadness and magnitude of the solid H resonan are discussed; the signal disappears below 1·3°K. T resonance of liq. D at the boiling point was considerab broader than liq. H and the relaxation time long [Abstr. 412 (1947)]. No change in resonance width relaxation time was observed for Li and F nuclei in L

o 1°K. Some further measurements were made on resonance by the method of nuclear induction.

2.1 : 530.14 = 3 3602

he possibilities and limits to the present theory of leus. FIERZ, M. *Experientia*, 3 (*No.* 8) 304–10 *In German.*—A review of the present nuclear theory s that meson theory is satisfactory for light nuclei. avy nuclei the liquid-drop model is not adequate.

G. J. K.

2.1 : 535.338.332 3603

erfine structure and nuclear moments of columbium^{93}. , W. W., AND FISHER, R. A. *Phys. Rev.*, **72,** 451–5 15, 1947).—Measurements have been made on the ne structure of 32 lines in the spectrum of CbI. is of these structures supports the previously ed spin value of 4½ units for the Cb^{93} nucleus and 32 hyperfine interval factors. These data, when conjunction with semi-empirical formulae for the ng between the nucleus and an *s* electron in the con- ion $4d^4\,5s$, lead to values for the nuclear *g*-factor uclear magnetic moment of 1·18 and 5·3 nuclear tons, respectively, for stable Cb^{93}. No nuclear c quadrupole moment is detected. A.

2.1 : 535.338.332 3604

ond-order magnetic perturbations in nuclear quadru- spectra and the "pseudo-quadrupole" effect in ic molecules. FOLEY, H. M. *Phys. Rev.*, **72,** 504–5 15, 1947).—In the evaluation of nuclear quadrupole ctions from the observed molecular beam or micro- spectra, it is essential to determine whether the ction between the nuclear magnetic moment and the of the orbital electrons may perturb the energy in the same manner as does a nuclear quadrupole ent. Such a perturbation may exist in the second- magnetic interaction. This note estimates the rtance of this and of several other closely related etic effects. A.

52.1 : 539.172.1 3605

ergy levels in the nucleus Mn^{56}. MARTIN, A. B. *Rev.*, **72,** 378–83 (*Sept.* 1, 1947).—The energy bution of the protons emitted in the reaction (d,p)Mn^{56} has been studied by an absorption od. For excitations up to 4·38 MeV above the nd state of the Mn^{56} nucleus, the protons are found ll into six distinct energy groups, corresponding to ed states at 1·07, 1·77, 2·48, 3·61 and 4·38 MeV e ground. Results are also presented which indicate the yields of the individual proton groups vary y with deuteron energy, showing no sharp resonance s. From the *Q*-value for the most energetic proton the mass of the nucleus Mn^{55} has been computed : 54·9634 ± 0·0022 mass units. A.

52.2 : 535.343.4–14 : 539.133 *see Abstr.* 3598

53 3606

ne structure of the hydrogen atom by a microwave od. LAMB, W. E., JR., AND RETHERFORD, R. C. *Rev.*, **72,** 241–3 (*Aug.* 1, 1947).—Hydrogen atoms bombarded by an electron stream. Metastable ^{2} atoms are detected by electron ejection from a l target. The current is reduced if radio-frequency ation is applied, for which $h\nu$ corresponds to the gy difference between one of the Zeeman components $^2S_{1/2}$ and any component of the *P* levels. The results cate that the $2^2S_{1/2}$ state is higher than the $2^2P_{1/2}$ by ·033 cm^{-1}, thereby showing that Dirac's theory is exact. The method will be extended to measure- ts of hyperfine structures, etc. L. P.

539.153 3607

The ^5S state of carbon. SHENSTONE, A. G. *Phys. Rev.*, **72,** 411–14 (*Sept.* 1, 1947).—The ^5S state of carbon is important in thermo-chemical theory, and its position has been the subject of much speculation. Evidence is here given that it is 33 735·2 cm^{-1} above the ground state ^3P, and combines with it to emit two lines at λ2965 and 2967. A.

539.153 : 530.145 3608

The electromagnetic shift of energy levels. BETHE, H. A. *Phys. Rev.*, **72,** 339–41 (*Aug.* 15, 1947).—The reported difference of energy of the $2s$ and $2p$ levels of H, in contradiction to the Dirac theory [Abstr. 3606 (1947)], is explained as an interaction energy of the electron with the radiation field. The calculated and observed values are in good agreement. The correction used is the difference of the interaction energies of the bound electron with the field, and that of a free electron with the same kinetic energy, since the latter is interpreted as part of the electronic mass. Calculation using non-relativistic radiation theory shows that this difference is still logarithmically divergent and ∞. A finite value is obtained by cutting off the spectrum at an upper energy limit of mc^2, since a relativistic calculation using hole theory is likely to give a finite result not differing essentially from this value. G. J. K.

539.155.2 3609

A new naturally occurring lanthanum isotope at mass 138. INGHRAM, M. G., HAYDEN, R. J., AND HESS, D. C., JR. *Phys. Rev.*, **72,** 349 (*Aug.* 15, 1947).—La^{138} was discovered by the mass spectrograph with an abundance of 0·089 ± 0·002%. No radioactivity could be detected. W. E. D.

539.155.2 : 521.042 3610

The relative abundance of some light nuclear species as determined from the composition of stony meteorites. BROWN, H., AND PATTERSON, C. *Phys. Rev.*, **72,** 456–7 (*Sept.* 15, 1947).—A statistical study has been made of the relative abundances of the major constituents of the silicate phase of stony meteorites. The results for the case of lithophile elements have been combined with data on isotopic abundances, thus giving figures for the abundances, relative to one another, of several nuclear species. The abundance ratios of three isobaric pairs, K^{40}–Ca^{40}, Ca^{46}–Ti^{46} and Ca^{48}–Ti^{48}, are given. A.

539.155.2 : 521.042 = 4 *see Abstr.* 3406–7

539.155.2 : 523.51 3611

The isotopic composition of meteoritic copper. BROWN, H., AND INGHRAM, M. G. *Phys. Rev.*, **72,** 347 (*Aug.* 15, 1947).—The ratio of Cu^{63} to Cu^{65} was found to be the same in the Canyon diablo meteorite as in ordinary terrestrial Cu. W. E. D.

539.155.2 : 523.51 3612

A comparison of the abundance ratios of the isotopes of terrestrial and meteoritic iron. VALLEY, G. E., AND ANDERSON, H. H. *J. Amer. Chem. Soc.*, **69,** 1871–5 (*Aug.*, 1947).—The isotopic composition of purified samples was determined by a mass spectrograph. No certain differences in composition were displayed. The ratios Fe^{54} : Fe^{56} : Fe^{57} : Fe^{58} = 6·33 : 100·00 : 2·34 : 0·32 were found. W. R. A.

539.155.2 : 533.15 : 541.123.5 3613

Enrichment of C^{13} and O^{18} by a counter-current gaseous exchange process using thermal diffusion. TAYLOR, T. I., AND BERNSTEIN, R. B. *J. Amer. Chem. Soc.*, **69,** 2076 (*Aug.*, 1947).—When the exchange reaction $C^{13}O + C^{12}O_2 = C^{12}O + C^{13}O_2$ is used with a thermal diffusion column enrichment of C^{13} and O^{18} occurs at the bottom of the column, the extent depending on the

nature of the filament. Pt was more effective than nichrome or W and its catalytic power was enhanced by the presence of H_2O. Dimensional details are given for the column, which establishes a counter-current flow of the exchanging gases. W. R. A.

539.155.2 : 536.48 3614

A new method of separation of the isotopes He^3 and He^4. Daunt, J. G., Probst, R. E., Johnston, H. L., Aldrich, L. T., and Nier, A. O. *Phys. Rev.*, **72**, 502–3 (*Sept.* 15, 1947).—An experiment of the type described in Abstr. 945 (1947) is reported. The liq. He removed to another vessel by superfluid transport showed very small or zero He^3 content, as measured by a mass spectrometer. The vapour above the liq. He II from which the transport took place, also showed a low He^3 content, indicating a complicated liquid/vapour equilibrium system at these temps., and probable enrichment of the liquid in He^3. It is concluded that He^3 does not take part in the superfluid transport at these, though it may at lower, temps. The differential superflow complicates He^3/He^4 vapour/liquid equilibrium, as He^4 would ascend the walls of the tube and evaporate where they warm up, providing a greater He^4/He^3 ratio in the vapour near the outlet to the sampling and measuring system.

539.155.2 : 537.561 3615

Mass-spectrometer study of the rare gases. Dibeler, V. H., Mohler, F. L., and Reese, R. M. *J. Res. Nat. Bur. Stand., Wash.*, **38**, 617–20 (*June*, 1947).—A study of the appearance potentials and isotope abundance of the rare gases has been made with a mass spectrometer as a check on the operation of the instrument. The results are comparable to previously published data. In addition, some new experimental values of ionization potentials have been obtained. Generally, good agreement of the isotope abundance measurements with previously published values obtained on other types of instruments and with chemically determined atomic weights, indicates a minimum of discrimination effects. The relative values of the ion currents for the rare gases were obtained and plotted against the atomic number. No simple relation between sensitivity and atomic number is evident. A.

539.155.2 : 539.167.3 *see Abstr.* 3642

539.155.2 : 541.123.59 *see Abstr.* 3701

539.155.2 : 541.133.1 = 3 3616

Enrichment of the heavy isotopes of Li and K by ionic migration in molten chlorides. Klemm, A., Hintenberger, H., and Hoernes, P. *Z. Naturforsch.*, **2a**, 245–9 (*May*, 1947) *In German.*—Enrichment of these isotopes at the boundary with $PbCl_2$ of LiCl containing 2 mole-% KCl. The change in the ratio Li^7/Li^6 was from 12·3 to 44·3 and in K^{41}/K^{39} from 0·0714 to 0·0885. From the total transfer of isotopes the ratios of ionic velocities with respect to Cl′, $W_{Li}/W_K = 1{\cdot}156$, $W_6/W_7 = 1{\cdot}021$ and $W_{39}/W_{41} = 1{\cdot}016$ were obtained. The comparatively low enrichment of K_{41} is ascribed to the fact that the K accumulates in a small region immediately behind the boundary, whereas the comparatively high value of W_{39}/W_{41} is assumed to be due to the low concentration of the K in the electrolyte. H. L.

539.155.2 : 545.827 *see Abstr.* 3720

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16 : 578.088.5 = 4 *see Abstr.* 3753

539.16 : 614.72 *see Abstr.* 3762

539.16 : 778.3 : 541.183 *see Abstr.* 3710

539.16.08 = 3

On the short tracks in photographic films. W
bacher, H., and Widhalm, A. *S.B. Akad. Wiss. W*
152, *Abt. IIa* (*Nos* 6–10) 173–91 (1943) *In Germa*
Stars consisting of not more than 5 tracks with ra
< ThC′ α-particles are examined. From a considera
of the number of tracks and their range many of the s
are attributable to radioactive contamination in
emulsion or deposited on the surface from the air.
many of the 3-track stars there appears a fourth t
nearby which is probably due to diffusion of the ra
active material in the gelatine. The number of 2-t
cosmic ray stars seems to be small. A procedure
measuring the depths of the tracks is described. W.

539.16.08 = 3

**Photographic intensity determination with the imp
spectrograph.** Maeder, D., Huber, P., and Stebler
Helv. Phys. Acta, **20** (*No.* 3) 230–4 (1947) *In Germa*
The impulse spectrograph measures the ampli
distribution in the investigation of nuclear reactions
an ionization chamber and a proportional ampl.
For each impulse a flash appears on the screen
cathode-ray tube, which is photographed. The techn
of the determination of the intensity of the imag
described. A definite standard blackening for each en
value is arrived at by a suitable copying process.
absolute intensities of the impulse spectrogram can
be obtained directly. A.

539.16.08 : 537.56

**A study of pulse shapes in a parallel-plate ioniz
chamber.** Sherr, R., and Peterson, R. *Rev.
Instrum.*, **18**, 567–75 (*Aug.*, 1947).—The general feat
of electron collection in a parallel-plate ioniza
chamber are discussed with reference to the detectio
single particles. If the particles come from the sur
of one of the electrodes and end their paths within
chamber, the pulses obtained by electron collection
give information regarding the energy of the parti
their range, the angle between the tracks and the fie
the chamber, and their "range-energy" function.
tronic and photographic measurements are descr
which confirm the expected form of the pulses
indicate the quantitative possibilities of this metho
detection.

539.16.08 : 621.318.57 = 4

**An automatic amplitude analyser and counter
proportional ionization chambers.** Kahan, T.,
Kwartiroff, A. *J. Phys. Radium* (*Sér.* 8) **7**, 3
(*Oct.*, 1946) *In French.*—[Abstr. 3072 B (1947)].

539.16.08 : 621.318.572 : 537.591.08 *see Abstr.* 3565

539.16.08 : 621.385.1 = 3

Counter tubes and point discharge counters. Br
mann, C. *Z. Instrumkde*, **64**, 46–64 (*Jan.–March*, 1
In German.—[Abstr. 3108 B (1947)].

539.163

Radioactive isotopes of Mo and Tc. Edwards, J
and Pool, M. L. *Phys. Rev.*, **72**, 384–9 (*Sept.* 1, 194
Evidence is presented which permits the assignment
4·3-day Tc activity to Tc^{96}. It decays by *K*-cap
X-ray photographs of long-period Tc activities show
X-rays resulting from *K*-capture decay of a 52-da
activity. Tc X-rays resulting from an isomeric trans
involving a 95-day Tc^{97*} activity were also photograp

539.163

Energy and half-life of the Be^{10} radioacti
McMillan, E. M. *Phys. Rev.*, **72**, 591–3 (*Oct.* 1, 194
The ½-life and upper limit β-ray energy of Be^{10} have

red, using a sample prepared from a strongly on-bombarded Be target. The upper limit energy, the inspection end-point of the absorption curve, ± 10 kev. The ½-life, from the specific activity isintegrations/sec per mg Be) and the directly red isotopic abundance (one part in 18 600) is : 0·5)×10⁶ years. A rough excitation curve and evidence for the absence of a γ-ray were also ied. A.

3 = 3 3624

7 sec isomer of Au^{197}. FRAUENFELDER, H., LOT, P. C., HUBER, O., MEDICUS, H., PREISWERK, HERRER, P., AND STEFFEN, R. *Helv. Phys. Acta*, 2. 3) 238–9 (1947) *In German.*—In agreement with nbeck [Abstr. 122 (1946)], the ½-life of the Au e obtained by irradiating Au with B + D neutrons ound to be 7·4 ± 0·3 sec. The absorption curve of the conversion electrons of Au^{197*} shows the nce of 2 electron groups of energies 0·07 MeV and MeV; β-β coincidence measurements show that these mitted in cascade. The two isomeric states of of ½-life 25 and 65 hr pass into Au^{197} by *K*-capture. ssion during these processes shows that Au^{197*} from the 25 hr Hg^{197*}. A. J. M.

63.1 3625

te on the disintegration energies of Na^{24} and Al^{28}. AS, W. H. *Phys. Rev.*, **72**, 346 (*Aug.* 15, 1947).—A , drawn to fit the experimental values of the dis- ration energies of Li^8, B^{12}, N^{16}, F^{20}, P^{32}, Cl^{36}, gives ntegration energy of Na^{24} consistent with Siegbahn's mination [Abstr. 3195 (1947)] and with the author's iations; the results for Al^{28}, however, do not fall on curve. W. E. D.

63.1 = 3 3626

estigation of short-lived metastable nuclear excita- states by means of retarded coincidences. HIRZEL, O., L., P., AND WÄFFLER, H. *Helv. Phys. Acta*, **20** 3) 241–5 (1947) *In German.*—A method of investiga- short-lived metastable nuclei by the observation of idences between the emitted β-particles and the s and their conversion electrons is described. A it for the amplifier is given. The method was used etermine the ½-life of Ce^{141} (70 ± 20 μsec) and of (1 200 ± 400 μsec). A. J. M.

163.2 3627

e radiations from 60-day Ir^{192} and 27-day Pa^{233}. , P. W. *Phys. Rev.*, **72**, 352–3 (*Aug.* 15, 1947).— γ-rays from Ir^{192} and Pa^{233} were investigated by surements on the conversion electrons with a 180° y spectrometer. The energies of 12 γ-rays are lated for Ir^{192} and of 4 for Pa^{233}. W. E. D.

163.2 3628

amma-radiation from tantalum, iridium, and gold. K, J. M. *Phys. Rev.*, **72**, 581–5 (*Oct.* 1, 1947).— using a photographic method in connection with -circular focusing magnetic spectrometers, the ectra due to internal conversion have been evaluated Au^{198}, Ir^{194} and Ta^{182}. For Au a simple spectrum 3 lines with differences the same as between the -*M* levels of Hg indicate a single γ-ray of energy 08 MeV following β-emission. In Ir, a complicated trum of >26 lines is observed which may be identified a the *K*-*L*-*M* differences in Pt as due to 12 γ-rays. se γ-energies appear to fit well with a level scheme of terms. Ta yields a spectrum of about 34 lines from ch about 16 γ-rays may be derived by applying the -*M* differences for W. These γ-energies fit satis- orily on a level scheme of 9 terms. A.

539.163.2 = 3 3629

An alpha-radiation ascribed to element 85. KARLIK, B., AND BERNERT, T. *S.B. Akad. Wiss. Wien*, **152**, *Abt. IIa* (*Nos* 6–10) 103–10 (1943) *In German.*—Observations on very freshly-prepared RaA showed the presence of an α-particle group of range 5·53 cm, whose intensity relative to the RaC′ α-particles decreased rapidly with time. A dual decay of RaA is postulated, in which ~3·3×10⁻⁴ of the disintegrations lead to formation of 85^{218} with a ½-life of a few seconds. A. P. F.

539.163.2 = 3 3630

The 53 min isotope of element 43. GUGELOT, P. C., HUBER, O., MEDICUS, H., PREISWERK, P., AND STEFFEN, R. *Helv. Phys. Acta*, **20** (*No.* 3) 240–1 (1947) *In German.* —By irradiation of Mo with protons an active isotope of element 43 is obtained which breaks down with emission of positrons and *K*-capture with a ½-life of 53 min. In addition to the annihilation radiation there is strong γ-radiation of energies 0·866 ± 0·006, 1·89 ± 0·06, and 2·84 ± 0·10 MeV. The conversion electrons of the 0·866 MeV γ-line have been investigated. A. J. M.

539.163.2 = 5 3631

Soft radiations emitted by $^{104}_{45}Rh$. AGENO, M. *Nuovo Cim.*, **1**, 415–31 (*Dec.*, 1943) *In Italian.*—Several measurements are made on the two isomers of Rh^{104} of ½-life 4·3 min and 41·8 sec respectively. In particular the internal conversion of the γ-ray emitted in the transition between the two isomers shows that such transition is probably due to a magnetic quadrupole moment. L. P.

539.163.2 : 537.531 3632

X-rays associated with U^{234}. MACKLIN, R. L., AND KNIGHT, G. B. *Phys. Rev.*, **72**, 435 (*Sept.* 1, 1947).— The *L* and *M* X-rays observed at the α-decay of U^{234} are found to follow the α-emission. The calculated energy of recoil at the α-emission is found to be 82 keV which is insufficient to excite the *K*-electrons, hence accounting for the absence of any *K*-lines. W. E. D.

539.163.2 : 539.185 3633

Evidence against spontaneous emission of neutrons by uranium X. DE VRIES, H., AND GROENDIJK, H. *Nature, Lond.*, **160**, 435–6 (*Sept.* 27, 1947).—See Abstr. 1116 (1946). The neutron emission of the UX in equilibrium with 1 kg of U was measured by the radioactivity induced in Ag, and was found to be negligible. The γ-ray absorption anomalies previously reported are ascribed to detection of secondary β-rays from the absorbers by the thin-walled counter used, and disappeared if the counter was surrounded by 0·5 mm of Pb.

539.164 : 539.172.4 *see Abstr.* 3652

539.164.08 3634

Quantitative alpha-particle counting by the emulsion technique. YAGODA, H., AND KAPLAN, N. *Phys. Rev.*, **72**, 356 (*Aug.* 15, 1947).—The number of α-particles emitted/sec/g of U is found to be 2·43 ± 0·07 × 10⁴ in good agreement with previous results. W. E. D.

539.164.2.02 : 621.318.23 = 4 3635

Large permanent magnet at Bellevue. ROSENBLUM, S., AND TSAÏ, B. *C.R. Acad. Sci., Paris*, **224**, 1278–80 (*May* 5, 1947) *In French.*—[Abstr. 3063 B (1947)].

539.164.74 = 3 3636

A search for inelastic scattering of alpha-particles. FISCHER-COLBRIE, E., AND JAWOREK, H. *S.B. Akad. Wiss. Wien*, **153**, *Abt. IIa* (*Nos* 1–10) 13–24 (1944) *In German.*—The energies of α-particles from RaC′ were measured, using a thin-window ionization chamber, after they had been scattered through a mean angle of 147° in a thin Al foil. No evidence for inelastic scattering was

found. A note on the preparation of very thin (2·5 mm air equivalent) windows is appended. A. P. F.

539.164.75 = 3 3637

A method for determining the air equivalents of foils for α-particles. HAWLICZEK, F. *S.B. Akad. Wiss. Wien*, **155**, *Abt. IIa* (*Nos* 5–6) 167–77 (1947) *In German.*—Insertion of a foil between a source and a detector of α-particles, the medium separating them being initially air, is compensated by movement of the source. The detector is an ionization chamber connected to a linear amplifier. The output pulses from the amplifier are rectified and charge a leaky condenser to a voltage ∝ their average size. This arrangement is very sensitive to the length of residual range spent in the chamber, and it is claimed that air equivalents can be measured to ~0·01 mm. A. P. F.

539.164.92 : 537.56 = 4 *see Abstr.* 3563

539.166 3638

Further experiments on the surplus gamma-radiation from granite. HESS, V. F. *Phys. Rev.*, **72**, 609–14 (*Oct.* 1, 1947).—Granite from Quincy, Mass., radiates γ-rays to the extent of about 100% above that due to its radioactive content. No explanation has yet been found. A.

539.166.08 : 537.542 = 4 3639

The efficiency of γ-ray counters. MARTY, N. *J. Phys. Radium* (*Sér.* 8) **8**, 29–32 (*Jan.*, 1947) *In French.*—γ-rays of energies 0·2–5 MeV are considered. Optimum wall-thicknesses over this range are given for Cu and Al counters. Values (obtained by summation over a finite number of wall elements) are given for the counted electrons produced from the wall by photo-electric, Compton, and pair-production effects. A limited experimental check gives quite good agreement. L. E. M.

539.166.9 3640

Angular correlation effects with annihilation radiation. PRYCE, M. H. L., AND WARD, J. C. *Nature, Lond.*, **160**, 435 (*Sept.* 27, 1947).—The two γ-rays emitted on annihilation of a slow positron-electron pair are polarized in perpendicular directions; the correlation in azimuth angle, if each quantum undergoes a Compton scattering, has been worked out, and indicates a greater probability of coincidence counts in perpendicular azimuths than in co-planar, the ratio being max. (~2·8) at photon scatter angle of ~80°. Somewhat similar results appear for photo-electrons ejected by the γ-rays.

539.166.93 : 541.141 *see Abstr.* 3708

539.167.3 = 5 3641

Radioactivity induced in Zr by fast neutron bombardment. AGENO, M. *Nuovo Cim.*, **1**, 33–40 (*Feb.*, 1943) *In Italian.*—Three new radioactive products are found, but not identified: (*a*) ½-life 22 min, β^+, max. energy 1–1·2 MeV; (*b*) 3 min, β^-, 3·2–3·5 MeV; (*c*) 5 sec. L. P.

539.167.3 : 539.155.2 3642

On the existence of a calcium isotope with an 8·5 day period. OVERSTREET, R., AND JACOBSON, L. *Phys. Rev.*, **72**, 349 (*Aug.* 15, 1947).—In an attempt to produce an 8·5 day activity previously alleged to be Ca^{41} [Abstr. 1097 (1940)], Ca^{40} and K^{41} were bombarded with 20 MeV deuterons in the hope of producing (*d*, *p*) and (*d*, 2*n*) reactions respectively, while A^{40} was bombarded with 40 MeV α-particles in an attempt to produce a (α, 3*n*) reaction. The conclusion was drawn that if a Ca^{41} isotope is produced by any of these processes its ½-life must be ≪ 1 day or > 1 year. W. E. D.

539.17 3643

Research in Germany on the technical application of atomic energy. HEISENBERG, W. *Nature, Lond.*, **160**, 211–15 (*Aug.* 16, 1947). *Transl. of Naturwiss.*, **33**, 325–9 (*Dec.* 15, 1946).—The account covers the pe from 1939 to April 1945. Heavy-water piles constructed which showed an increasing neutron den but none was self-sustaining, though the last one (1½ U, 1½ tons D_2O, 10 tons graphite for outer shield failed by only a narrow margin. Progress was rou parallel with the American up to 1942, except in the of isotope separation, but large industrial resources never subsequently allotted to the work, as an ato bomb was considered to be too long-scale a project.

539.172

Fission of bismuth, lead, thallium, platinum, tantalum with high energy particles. PERLMAN, GOECKERMANN, R. H., TEMPLETON, D. H., AND HOWL J. J. *Phys. Rev.*, **72**, 352 (*Aug.* 15, 1947).—Fissio these atoms was produced by one or more of the jectiles: α-particles, deuterons and neutrons, whose energies were respectively 400, 200 and 100 MeV. estimate is also given of the relative yields of the isot resulting from the (Bi + α) fission. W.

539.172 : 537.591.8

"Evaporation" of heavy nuclei. PERKINS, D. *Nature, Lond.*, **160**, 299–301 (*Aug.* 30, 1947).—An en spectrum-histogram has been prepared of the part involved in 15 cosmic ray disintegration "stars" obse in photographic emulsions (Ag and Br disintegratio The shape is discussed on the basis of the hypoth that the "temperature" of a nucleus is raised whe absorbs energy from a cosmic ray, various part being "evaporated" after "thermal" equilibrium reached. The existence of a high-energy tail to diagram (9% of stars are protons >50 MeV) indic that evaporation takes place before equilibrium reached. This is supported by the fact that a numbe stars are not spherically symmetrical. Simple modified formulae are put forward for defining the c in terms of nuclear "temp." and barrier height.

539.172.1 : 537.534 : 621.384.6

The one million-volt accelerating equipment of Cavendish Laboratory, Cambridge. BURCHAM, W. *Nature, Lond.*, **160**, 316–17 (*Sept.* 6, 1947).— apparatus provides a magnetically resolved beam protons or deuterons of 70–100 μA. The maxim design voltage is 1 250 kV but this value cannot be owing to the proximity of the laboratory walls. Wi pressure in the accelerating tube of <0·0003 mm steady operation at 950 kV is achieved. About 3 cm H_2 are consumed per minute. A short description of applications of the equipment is given, including w on transmutation. The h.t. generator is of Ph construction, and has been in continuous use for years. N.

539.172.1 : 539.152.1 *see Abstr.* 3605

539.172.11

The ejection of protons from nitrogen on bombardm with α-particles of short range. CHAMPION, F. C., ROY, R. R. *Proc. Roy. Soc. A*, **191**, 269–77 (*Nov.* 1947).—Using the expansion-chamber method, 90 pro tracks were obtained from 850 photographs showing disintegration of N under bombardment by slow particles. The number of disintegrations decreases the energy of the α-particles is reduced, but the ph graphs show disintegrations occurring for ener < 1·7 MeV. The angular distribution is app isotropic for the protons ejected by α-particles of ene <3 MeV, but there is a marked preponderance at ab. 90° for the protons ejected by α-particles of range ~2 in air at N.T.P. Typical photographs are reproduced

72.13 3648

etaborate compounds for internal cyclotron targets. , A. S., Reid, A. F., and Dunning, J. R. *Rev. Sci. um.*, **18**, 556–8 (*Aug.*, 1947).—The use of $NaBO_2$ as get material for the preparation of radioactive Na^{24} ugh the deuteron bombardment reaction $_{11}Na^{23} + _1p^1 \rightarrow _{11}Na^{24} + _1p^1$ is discussed. The general advantages $NaBO_2$ as a target material are given, as well as the edure for target preparation and the details of the nical treatment used for the purification of the Na^{24}. general use of metaborate targets is discussed briefly other deuteron bombardment reactions in which an entary target material is less practical to use. A.

172.4 3649

etermination of the ranges of the fission fragments ting delayed neutrons. Chemical identification of the -sec delayed neutron activity. Sugarman, N. *J. n. Phys.*, **15**, 544–51 (*Aug.*, 1947).—The ranges of the on fragments leading to delayed neutron emission e been determined by absorbing the fragments in Al counting the penetrating activity. The delayed tron activities and their corresponding ranges in Al rected for source thickness are: 4·51 sec, 4·05 ± 0·03; 6 sec, 3·98 ± 0·06; 1·52 sec, 3·63 ± 0·12; 22·0 sec, 1 ± 0·04 mg Al/cm². Comparing the range of the 1 sec activity with that of the 55·6 sec Br, one finds t mass assignments possible for the 4·51 sec activity 86 to 90. Similarly, the range of the 1·52 sec activity ompared to that of the 22·0 sec I, and the possible ss assignments found are 129 to 135. Chemical aration of Br from irradiated uranyl nitrate resulted he identification of the 4·51 sec activity as an isotope Br. A.

).172.4 3650

The yield of nuclei formed by fission. Dempster, A. J. *ys. Rev.*, **72**, 431 (*Sept.* 1, 1947).—Assuming a total ss of 234, curves are plotted of E and d against the ss difference of pairs of fission products, where E is kinetic energy acquired by the pair calculated from ss defect data, and d is the distance apart of the two ion products such that their Coulomb potential energy uals their final kinetic energy, E. For large mass ference the value of d would have to be unreasonably ge to result in the small value of E observed; whereas equal masses the value of E is a max., and an unusual ocess of separation would be required in such a case. termediate mass differences, as met with experimentally, e therefore to be expected. W. E. D.

9.172.4 = 4 3651

Action of slow neutrons on nitrogen, studied by the otographic emulsion method. Cüer, P. *J. Phys. adium* (*Sér.* 8) **8**, 83–6 (*March*, 1947) *In French.*—bservations on the slow neutron $N^{14}(n, p)$ reaction, ing loaded plates, are described. The energy of the action is given as 0·60 ± 0·03 MeV, and the cross-ction, found by comparison with the $Li^6(n, \alpha)$ reaction, $\sim 1 \cdot 3 \times 10^{-24}$ cm². A. P. F.

39.172.4 : 539.164 3652

Alpha-particles associated with fission. Wollan, E. O., loak, C. D., and Sawyer, R. B. *Phys. Rev.*, **72**, 447–51 *Sept.* 15, 1947).—Twenty tracks in photographic mulsion of long range particles associated with the ssion of U were observed and studied. From the grain pacing along the tracks it was possible to show that the articles are not protons but are most likely α-particles. he max. range observed is ~40 cm of normal air. rom the distribution in angle with respect to the fission racks, it is shown that the αs are not emitted from the fission fragments but are released as a part of the fission process. A.

539.172.4 : 539.185 3653

Studies of the delayed neutrons. I. The decay curve and the intensity of the delayed neutrons. Snell, A. H., Nedzel, V. A., Ibser, H. W., Levinger, J. S., Wilkinson, R. G., and Sampson, M. B. *Phys. Rev.*, **72**, 541–4 (*Oct.* 1, 1947).—The delayed neutrons resulting from slow neutron fission of U have been found to decay as a combination of exponentials with ½-lives of 0·4, 1·8, 4·4, 23, and 56 secs and respective initial relative intensities when activated to saturation of 0·4, 0·5, 1·1, 1·0, and 0·14. Under equilibrium conditions the delayed neutrons are 1·0 ± 0·2% as abundant as the instantaneous fission neutrons. A.

539.172.4 : 539.185 3654

Studies of the delayed neutrons. II. Chemical isolation of the 56-second and the 23-second activities. Snell, A. H., Levinger, J. S., Meiners, E. P., Jr., Sampson, M. B., and Wilkinson, R. G. *Phys. Rev.*, **72**, 545–9 (*Oct.* 1, 1947).—The 23 sec delayed neutron activity is found to follow the chemistry of I, and the 56 sec activity, Br. Comparison with known β-emitters of like ½-lives suggests that the neutron-emitting nuclei may be Xe^{137} and Kr^{87}. A.

539.172.4 : 539.185 3655

Delayed neutrons from Pu^{239}. de Hoffmann, F., and Feld, B. T. *Phys. Rev.*, **72**, 567–9 (*Oct.* 1, 1947).—The shape of the decay curve of Pu^{239} delayed neutrons is found to be very nearly the same as that of U^{235}. The ratio of the relative number of delayed neutrons in Pu^{239} to that in U^{235} was found to be 0·47 for neutrons delayed over 2 sec and 0·40 for neutrons delayed over 5 sec. In the light of the experimental errors, it is questionable whether these numbers are significantly different. A.

539.172.4 : 539.185 3656

Delayed neutrons in plutonium and uranium fission. Redman, W. C., and Saxon, D. *Phys. Rev.*, **72**, 570–5 (*Oct.* 1, 1947).—Samples of Pu^{239} and U, enriched in the 235-isotope, were irradiated in a graphite pile. The decay of the delayed neutrons following fission was recorded on a magnetic wire recorder. Analysis of the decay data, 18 runs with Pu^{239}, and 37 with U, gave the following expression for the decay curves: $A_t = C_{Pu}(1 \cdot 2e^{-0 \cdot 660t} + 1 \cdot 1e^{-0 \cdot 154t} + 1 \cdot 0e^{-0 \cdot 0309t} + 0 \cdot 10e^{-0 \cdot 0127t})$, for Pu^{239}, and: $A_t = C_U(1 \cdot 65e^{-0 \cdot 613t} + 1 \cdot 36e^{-0 \cdot 156t} + 1 \cdot 00e^{-0 \cdot 0308t} + 0 \cdot 15e^{-0 \cdot 0126t})$, for U^{235}, when all the periods are irradiated to saturation. Within the limits of experimental error, the ½-lives for Pu^{239} and U^{235} are identical, namely: (55·0 ± 0·4) sec, (22·5 ± 0·3) sec, (4·45 ± 0·15) sec, and (1·10 ± 0·06) sec. The change in the yield of the 55·0 sec period relative to that of the 22·45 sec period, in going from U^{235} to Pu^{239}, is of the proper sign but small in magnitude as compared to the change predicted from the fission yields for the known mass numbers of these delayed-neutron emitters. A comparison of the relative number of delayed neutrons per fission gives the ratio of the number from Pu^{239} to the number from U^{235} as 0·5. A.

539.172.4 + 539.185.7 = 5 *see Abstr.* 3679

539.18 3657

Cloud-chamber search for a low mass neutral particle. Kruger, P. G., and Smith, L. W. *Phys. Rev.*, **72**, 360–1 (*Sept.* 1, 1947).—The possibility that certain anomalous electron tracks in a cloud chamber may be due to decay of a low mass neutral particle has been examined, and it is concluded that such tracks are not caused by decay electrons. This conclusion is necessary because of the

failure to observe such tracks in 5 000 pictures when H gas was used in the cloud chamber instead of air. A.

539.18 3658

The capture of negative mesotrons in matter. FERMI, E., AND TELLER, E. *Phys. Rev.*, **72**, 399–408 (*Sept.* 1, 1947).—A detailed discussion of the energy loss of negative mesotrons in matter is presented. The energy range considered is from +2 000 eV to the lowest quantized orbit of the mesotron. The most important mechanism for energy loss is that of electron collisions except very near the nucleus, where radiation losses are important. The time for the over-all process is $\sim 10^{-13}$ sec in condensed matter and 10^{-9} sec in normal air. In chemical compounds the probability of capture near the various atoms is roughly proportional to their atomic numbers. A.

539.18 3659

On the two-meson hypothesis. MARSHAK, R. E., AND BETHE, H. A. *Phys. Rev.*, **72**, 506–9 (*Sept.* 15, 1947).—A hypothesis is advanced that "heavy" mesons are produced with large cross-section by cosmic rays in the upper atmosphere, but that most of these decay to "light" mesons (the normally observed type) which have weak interaction with matter. The possible masses, and life-time of the heavy meson, are discussed; upper and lower limits to the latter can be fixed by reference to meson capture, scattering and underground absorption experiments, and to meson decay photographs. [Abstr. 2237 (1947)]. Various processes of the two mesons with nucleons are discussed.

539.18 = 3 3660

On the elastic scattering of mesons. URBAN, P. *S.B. Akad. Wiss. Wien.*, **155**, *Abt. IIa* (*Nos* 5–6) 179–88 (1947) *In German.*—Differential and total cross-sections are calculated for the scattering of scalar mesons by nucleons, as a function of energy. G. J. K.

539.18 : 530.145 3661

The γ-instability of mesons. FINKELSTEIN, R. J. *Phys. Rev.*, **72**, 415–22 (*Sept.* 1, 1947).—The following examples of γ-instability are investigated: (*a*) $M_0 \rightarrow \gamma_1 + \gamma_2$, (*b*) $M_1 \rightarrow \gamma_1 + \gamma_2 + \gamma_3$, (*c*) $M_1 \rightarrow M_0 + \gamma$, (*d*) $M_1^{\pm} \rightarrow M_0^{\pm} + \gamma$, where M_0 and M_1 mean a pseudoscalar and a (heavier) vector meson, respectively, and the superscript ± indicates the charge, if there is one. If the coupling constant and meson masses appropriate to the Schwinger mixture are used, the life-times are found to be: $\tau_a = 1 \times 10^{-16}$ sec, $\tau_b = 2 \times 10^{-11}$ sec, $\tau_c = 1 \times 10^{-18}$ sec, and $\tau_d = 4 \times 10^{-18}$ sec. In all cases except (*b*) the calculation leads to logarithmically divergent integrals. A.

539.18 : 537.591 3662

Decay of negative mesons in matter. FRÖHLICH, H. *Nature, Lond.*, **160**, 255 (*Aug.* 23, 1947).—If an assembly of electronic oscillators is used as a model of a solid, the rate of loss of energy of a negative meson in passing through a solid ≪ than that calculated by Fermi *et al* [Abstr. 1634 (1947)] on the basis of a free electron gas, giving opportunity for decay before capture. Present ideas of nucleus/meson interaction are thus not necessarily upset by Conversi's observations [Abstr. 1313 (1947)].

539.185 3663

On the scattering of fast neutrons by protons. RAMSEY, W. H. *Proc. Roy. Soc. A*, **191**, 195–209 (*Nov.* 11, 1947).—The features of the scattering of fast neutrons by protons are calculated using the Møller–Rosenfeld version of the meson theory of nuclear forces. The experimental results of Occhialini and Powell are used to check the predicted angular distribution of the scattered particles and to determine the mass of th meson; the meson mass indicated ≃215 electron masses, which agrees with the mass of cosmic ray meson. The total scattering cross-section predicted by the theor agrees with the empirical results.

539.185 366

Spin dependence of scattering of slow neutrons by B Al, and Bi. FERMI, E., AND MARSHALL, L. *Phys. Rev* **72**, 408–10 (*Sept.* 1, 1947).—Some information has bee obtained by measuring the scattering cross-section fo filtered neutrons. The result is that in none of thes three cases does the sign of the scattering length chang when the spin orientation is changed. But in the case o Be and Bi the magnitude of the scattering length for on spin orientation may be up to 2× that for the other spi orientation, and in the case of Al up to 3×.

539.185 366

An upper limit for the cross section for scattering neutrinos by hydrogen. WOLLAN, E. O. *Phys. Rev.*, 7 445–6 (*Sept.* 15, 1947).—No ionization could be detecte in a H-filled chamber near the Clinton pile under nearl ideal shielding conditions. The known sensitivity of th chamber gives the cross-section limit as 2×10^{-30} cm².

539.185 366

Milne's problem in transport theory. PLACZEK, G AND SEIDEL, W. *Phys. Rev.*, **72**, 550–5 (*Oct.* 1, 1947).— A modified derivation of the Wiener–Hopf solution c Milne's problem is given in a form suitable for applica tion to problems in the theory of neutron diffusion.

539.185 366

The angular distribution of neutrons emerging from plane surface. PLACZEK, G. *Phys. Rev.*, **72**, 556– (*Oct.* 1, 1947).—The Wiener–Hopf expression for th angular distribution in Milne's standard case is trans formed into a form suitable for numerical evaluatior The results of the evaluation are given.

539.185 366

The neutron density near a plane surface. MARK, C *Phys. Rev.*, **72**, 558–64 (*Oct.* 1, 1947).—The exact solutio of Milne's integral equation is expressed as a real integra with non-oscillating integrand. This expression has bee derived from the Wiener–Hopf solution for the Laplac transform of the density. The values of the first thre moments of the difference between the density and th asymptotic density, and an expansion of the density fo points near the boundary are also given. Various author have proposed or obtained approximations to th solution of this problem, and some of these approxima tions are referred to and compared with the exac solution.

539.185 366

Application of a variational method to Milne's problem LECAINE, J. *Phys. Rev.*, **72**, 564–6 (*Oct.* 1, 1947).—A approximate solution of Milne's integral equation for th neutron density is obtained by a variational method wit high accuracy in simple analytical form. The extra polated asymptotic density at the boundary is given b this method correct to 0·4 parts in a million. Th density itself has a max. error of 0·3% which occurs a the boundary, and <0·05% for all distances beyon 0·05 mean free paths. A simple expression for th angular distribution of emerging neutrons is als obtained.

539.185 367

The scattering of slow neutrons by bound protons III. Intermediate energies. ZILSEL, P. R., DARLING, B. T. AND BREIT, G. *Phys. Rev.*, **72**, 576–80 (*Oct.* 1, 1947).— The calculation of the cross-section for scattering o

ons by elastically bound protons is extended to ies up to the first excited state. As in the preceding s [Abstr. 1642–3 (1947)] the results are expressed in of a correction factor to be applied to Fermi's oximation. This factor has been evaluated for a er of energies and angles of scattering. In all cases orrection is small and $\simeq 0{\cdot}3\%$. A.

85 : 539.163.2 *see Abstr.* 3633

85 : 539.172.4 *see Abstr.* 3653–6

85.7 3671

the high energy neutron-proton scattering. LOPES, *Phys. Rev.*, **72**, 355–6 (*Aug.* 15, 1947).—Calculations that it will be difficult to check the strong coupling y of Møller and Rosenfeld by nucleon-nucleon ering experiments. W. E. D.

.85.7 3672

the slow neutron absorption resonances in iodine. S, W. B., JR. *Phys. Rev.*, **72**, 362–77 (*Sept.* 1, 1947).— 12-channel slow neutron velocity spectrometer str. 1002 (1947)] is described, and measurements on s-section of the single stable I nucleus for an energy e 0·0026 to 1 000 eV reported. The $1/v$ law is ed <3 eV; at thermal energies, total cross-section $0{\cdot}3\times10^{-24}$, scattering cross-section $3{\cdot}6\times10^{-24}$ cm². ngle resonance was observed at 20·3 eV and Breit– ner constants for it are quoted; the absorbers used ; however, thick. A region containing at least 3 nances which could not be resolved was observed veen 25 and 50 eV (absorbers also thick); the widths estimated at <2 eV. Evidence of further resonances found near 85 eV. A.

.185.7 3673

otal cross section of aluminum for fast neutrons. GONDOLLAR, L. W., AND BARSCHALL, H. H. *Phys.* ., **72**, 439–44 (*Sept.* 15, 1947).—The cross-section was sured as a function of neutron energy in the range n 10 to 1 000 keV. Neutrons of known mean energy small energy spread were produced by the Li(p, n) tion. The cross-section was found to be a rapidly ying function of energy, indicating the presence of at t 10 resonances in the range of energies investigated. extreme values of the cross-section were found to be and $11{\cdot}5\times10^{-24}$ cm². A.

.185.7 3674

Neutron cross-section studies with the rotating shutter chanism. BRILL, T., AND LICHTENBERGER, H. V. *s. Rev.*, **72**, 585–90 (*Oct.* 1, 1947).—It has been ssible to extend the usefulness of the rotating shutter chanism [Abstr. 2983 (1947)] for velocity selection of trons by increasing the number of photo-electrically vated gate circuits. With the modifications here scribed data can be obtained simultaneously in six i-resolved velocity intervals. In this way the cross- tions of Au, Gd and Dy have been measured as a ction of velocity for low energy neutrons. A.

.185.7 3675

Interaction of neutrons with electrons in lead. HAVENS, . W., JR., RABI, I. I., AND RAINWATER, L. J. *Phys. v.*, **72**, 634–6 (*Oct.* 1, 1947).—The scattering of slow utrons by solid and liquid Pb has been measured as a nction of the wavelength of the neutron. This scatter- g is the sum of nuclear and electron scattering, and an tempt is made to separate out the two effects. The t electron effect is rather less than that expected oretically from a 5 000 eV potential well, and appears cause a diminution of total scattering, indicating a utron-electron attraction.

539.185.7 = 5 3676

Nuclear forces and some experimental results on neutron-proton scattering. FERRETTI, B. *Nuovo Cim.*, **1**, 25–32 (*Feb.*, 1943) *In Italian.*—The differential cross-section for proton-neutron scattering is calculated on the basis of the Møller–Rosenfeld theory, taking into account only the static interaction terms. Writing

$$\sigma(\theta) = \sigma_0(a + b\cos\theta + c\cos^2\theta + \ldots),$$

the author finds: $b/(a + c) = -0{\cdot}06$. L. P.

539.185.7 = 5 3677

The slowing down of neutrons in substances containing hydrogen. AGENO, M. *Nuovo Cim.*, **1**, 41–8 (*Feb.*, 1943) *In Italian.*—The slowing down and diffusion of neutrons in paraffin is studied under the assumption that the proton-neutron scattering is not isotropic in the centre of gravity system. It is not practically possible to check by experiment the theoretical results obtained. L. P.

539.185.7 : 530.14 = 5 3678

Neutron-proton scattering and non-static nuclear forces. FERRETTI, B. *Nuovo Cim.*, **1**, 229–52 (*June*, 1943) *In Italian.*—The effect of the non-static interaction terms on the proton-neutron scattering in the Møller–Rosenfeld theory is discussed. It is shown that, despite the elimination in this theory of the "static infinities," cutting off at small distances is still necessary to eliminate diverging terms. L. P.

539.185.7 + 539.172.4 = 5 3679

Neutron scattering by protons and deuterons. AGENO, M., AMALDI, E., BOCCIARELLI, D., AND TRABACCHI, G. C. *Nuovo Cim.*, **1**, 253–78 (*June*, 1943) *In Italian.*—The scattering cross-section of H, D, C, for neutrons of 4·1, 12·5, 13·5 MeV was measured using, as neutron detectors: (*a*) three proportional counters in coincidence; (*b*) the activity induced in Cu^{63}. The process D(n, $2n$)H was also investigated, the cross-section for 11–15 MeV neutrons being certainly $<10^{-25}$ cm². L. P.

STRUCTURE OF SOLIDS 539.2

539.2 : 666 3680

The relation between the physical properties and the structure of glass. I. Variations of the physical properties with time. DOUGLAS, R. W. *J. Soc. Glass Tech.*, **31**, 50–73(*T*) (*Feb.–April*, 1947).—The X-ray diffraction patterns of liquids and glasses are compared; it is shown that the similarities between them enable a qualitative application to be made to glasses of Bernal's theoretical work on the liquid state [Abstr. 1420 (1937)]. In this way a satisfactory account may be given of the time-variation of the physical properties of glasses in the temp. range for which their viscosity $> \sim 10^{13}$ poises, in terms of a random network structure involving no considerations of aggregation or association. A.

539.2 : 666 : 532.13 3681

The relation between the physical properties and the structure of glass. II. Viscosity as a function of temperature. DOUGLAS, R. W. *J. Soc. Glass Tech.*, **31**, 74–89(*T*) (*Feb.–April*, 1947).—Log (viscosity of normal liquids) $\propto 1/T$ °A, but the viscosity of glass cannot be so expressed. It is shown that the viscosity-temp. relationship of glasses can be predicted from the assumptions of a random network structure which possesses an equilibrium configuration for each temp. A.

539.23 : 532.516 3682

An electron-diffraction study of the heating of straight-chain organic films and its application to lubrication. BRUMMAGE, K. G. *Proc. Roy. Soc. A*, **191**, 243–52

(*Nov.* 11, 1947).—Thin films of normal paraffins, fatty acids and esters have been examined by electron diffraction during heating upon a variety of metal surfaces. In all cases the films lost their orderly condensed structure at a comparatively low temperature, leaving expanded films of individual molecules. The disorientation temperatures observed depended upon the chemical composition and thickness of the films, and upon the substrate metal. Evidence has been obtained of the formation of metallic soaps when fatty acid films are deposited upon reactive surfaces such as Cu, Cd and mild steel. Close agreement has been found between disorientation temps. and the temps. of friction discontinuities measured by other workers using Bowden–Leben type friction apparatus. A.

539.23 : 535.39 *see Abstr.* 3493

539.23 : 536.63 : 536.48 *see Abstr.* 3514

539.26 : 539.374 *see Abstr.* 3692

539.26 : 548.73 : 621.365.41 3683

A high temperature X-ray diffraction apparatus. Birks, L. S., and Friedman, H. *Rev. Sci. Instrum.*, **18**, 576–80 (*Aug.*, 1947).—An apparatus is described for heating an X-ray specimen to 1 200°C in vacuum while its diffraction pattern is being recorded continuously on a Geiger counter spectrometer. The heater consists of a length of 0·030-in W wire embedded in BeO, the whole enclosed in a polished Ta case. Either a flat metal sheet, or powder packed in Pt gauze mounted on sheet metal is suitable as a specimen. An area about 1 cm² in the centre of the specimen is irradiated by the X-ray beam in the focusing type of spectrometer. The temperature is uniform over this area to ± 5°C. Two concentric radiation shields reduce heat loss. The outer shield also acts as the vacuum-tight body of the oven and has Be windows to pass the X-rays. Results indicate that rapid structure changes may be observed as they occur with this apparatus. A.

539.27 : 621.365.41 3684

High temperature furnace for electron diffraction studies. Gulbransen, E. A. *Rev. Sci. Instrum.*, **18**, 546–50 (*Aug.*, 1947).—A furnace is described for use with the electron diffraction camera for the study of chemical and physical reactions occurring on surfaces up to 1 000°C. The specimens are mounted in the body of a Cr–Ni alloy block, surrounded by radiation shields and heated internally by a W-wire heating element mounted on a BeO core operating in a H_2 atmosphere. The motions necessary for manipulation of the specimens are accomplished through a Wilson seal. Temperatures of 1000°C are achieved with a heat input of 450 to 500 W in 40 min. The use of the furnace is illustrated. A.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.31 = 3 3685

A relation between the theory of Bennewitz and Roetger for internal friction and that of Paesler. Päsler, M. *Z. Phys.*, **124** (*Nos* 1–2) 105–17 (1947) *In German.*—It is shown that the equations developed by Päsler [Abstr. 2066 (1946)] in considering the theory of internal friction bear a relation to the fundamental differential equations developed by Bennewitz and Roetger [Abstr. 1023 (1939)]. From the expanded equations of motion of an oscillator and the generalized heat conduction equation, one arrives at a differential equation for the displacement vector, after eliminating the excess temp. arising from the deformation of the oscillator. The additional elasticity modulus ε introduced by B. and R. is shown to be expressible in terms of material constant which can be determined by experiment. Similarly th compensating coeff. $\gamma \propto$ the heat conductivity of th oscillator. The quantities ε and γ can be treated i terms of an electrical analogy and so evaluated. G. O. J.

539.313 368

Generalized mechanical properties of solid bodie Friedmann, J. B. *C.R. Acad. Sci. URSS*, **55** (*No.* 9 817–20 (1947).—The author has investigated the relatio between max. shear stress and the resultant strai according as to whether the material is in tension, torsion or compression. For duralumin and high strength A alloys the shearing strain is a function of shear stress onl but there are anomalies in the case of certain steels. L. G. (

539.32 368

High speed compression tests on copper. Greenfield M., and Habib, E. T. *J. Appl. Phys.*, **18**, 645–9 (*Jul* 1947).—Dynamic shortening of ½-in long Cu cylinders achieved by striking them with a hardened steel pro jectile at high velocities. The average strain rate wa ~ 1 200/sec. Energy per unit vol. absorbed by the C is plotted against strain. A true stress/logarithmic strai curve is computed. This curve is compared with similar curve derived from high speed tests on Cu i tension.

539.32 368

Large strains and displacements in stress-strain problem Swainger, K. H. *Nature, Lond.*, **160**, 399–400 (*Sept.* 2 1947).—A short account is given of a theory giving th relationship between the stresses and any finite values displacement and strains in a loaded structure. "True strain is defined as (stretched − initial length)/(stretche length) and can never >1; "true" stress = load/(actu cross-section). The generalized theory includes pos yield stresses, non-orthogonal co-ordinates and anisotrop bodies.

539.32 : 541.183.576 : 537.311.33 *see Abstr.* 3537

539.32 : 548.0 368

Elastic constants of magnetite, pyrite and chromit Doraiswami, M. S. *Proc. Indian Acad. Sci. A*, **26**, 413–1 (*May*, 1947).—Elastic constants of two specimens magnetite from Holenarasipur in Mysore, four specime of pyrite from Macherla in Guntur district, and or specimen of chromite from Kondapalle in Kistna distri have been determined by the ultrasonic wedge method. W. R.

539.371/.374 369

The theory of combined plastic and elastic deformatio with particular reference to a thick tube under intern pressure. Hill, R., Lee, E. H., and Tupper, S. *Proc. Roy. Soc. A*, **191**, 278–303 (*Nov.* 1, 1947).—Th relationship between stress and strain is represented on plane diagram, the reduced stress-strain diagram, whic facilitates discrimination between the elastic and plast components of strain and aids considerably the solutio of certain problems. The diagram can also be used t express the relationships governing the dissipation energy during plastic flow under combined stresse The theory is applied to the deformation of a long thic tube under internal pressure with zero longitudin extension. The solution is compared with that based o the usual theory which neglects elastic strains in the plast region, revealing an error which reaches a max. of >60 in the longitudinal stress distribution. The significance the differences between the two solutions is discussed i detail.

.374 3691
X-ray diffraction studies of yielding in mild steel. FELL, W. *Nature, Lond.*, **160**, 259 (*Aug.* 23, 1947).—See str. 2666 (1947); earlier reports on this subject are listed.

.374 : 539.26 3692
Residual lattice strains in plastically deformed metals. EENOUGH, G. B. *Nature, Lond.*, **160**, 258 (*Aug.* 23, 7).—It is shown that the residual lattice strains on noval of stress [Abstr. 2076 (1944)] should be widely erent for different orientations of grain; thus grains ich have yielded relatively readily during extension l, after release, be in compression, and their high ld-tension neighbours will be in compression. This is nfirmed by X-ray diffraction patterns from a number different planes of strained Fe, Cu and Al wires, the pective planes being identified and strain measured by nparison with similar patterns of the same wires after nealing. Both positive and negative residual strains re found.

9.389.1 3693
Upper yield point: occurrence in bending tests and nification. BENEDICKS, C., AND SKORSKI, R. *Nature, nd.*, **160**, 399 (*Sept.* 20, 1947).—Two examples of the currence of the upper yield point are described. It is own that this is probably associated with the presence a hard skeleton in the metal, e.g. cementite precipitated grain boundaries. The upper yield point represents e rupture of this skeleton.

9.389.3 : 666 3694
The delayed elastic effect in silicate glasses at room nperature. MURGATROYD, J. B., AND SYKES, R. F. R. *Soc. Glass Tech.*, **31**, 17–35(*T*) (*Feb.–April*, 1947).—he effect has been measured at 12°C in vitreous silica, boro-silicate glass and a sheet glass, using a torsion ılance of high sensitivity with an optical lever. Expresng the delayed strain between 1 and 10^4 min after loading % of total strain, the following values were found: for treous silica, 0·12%, for "Wembley X-8," 0·55%, and r sheet glass, 1·2%. The empirical equation, strain = $+ b \log t$ (a and b being const. for a particular glass), as shown to hold to a close approx., although it does not press the results when very close to the limiting strain. was demonstrated that the delayed elastic effect is versible and regularly reproducible, and in all respects onforms with the assumption that glass consists of a truly lastic matrix containing inclusions of viscous comonents possessing a wide range of viscosities. A.

39.389.3 : 666 : 539.4.011.25 3695
The relation between the delayed elastic effect and the ecay of strength of silicate glasses at room temperature. MURGATROYD, J. B., AND SYKES, R. F. R. *J. Soc. Glass Tech.*, **31**, 36–49(*T*) (*Feb.–April*, 1947).—A relationship is derived between breaking strength and the delayed strain which appears in glass under constant load, namely, $1/P_B = k\sigma + k'$ (P_B = breaking strength, σ = strain). P_B and σ were measured at durations of loading varying from 1 to 10^4 min in vitreous silica, "X-8" glass and sheet glass and the results were in close agreement with the equation. This supports the assumption that stress concentrations arise locally in the elastic matrix of glasses where inclusions of a quasi-viscous component occur, and that these stress concentrations continue to increase as relaxation proceeds in the quasi-viscous component. An explanation is offered of the fact that $1/P_B \propto$ log (duration of loading) + const. The effect of surface condition on the strength of glass is also discussed, and it is shown that the lack of decay of strength of glass under load after being heated *in vacuo* is compatible with the "viscous pocket" theory. A.

539.4.011.25 : 666 : 539.389.3 *see Abstr.* 3695

539.42 : 539.89 : 539.56 3696
Remarks on compressive and tensile strengths. THOMPSON, S. *J. Appl. Phys.*, **18**, 781–2 (*Aug.*, 1947).—An explanation of some of the anomalies occurring in the work of Abstr. 1658 (1947).

539.434 3697
Andrade's creep law and the flow of zinc crystals. COTTRELL, A. H., AND AYTEKIN, V. *Nature, Lond.*, **160**, 328–9 (*Sept.* 6, 1947).—Single Zn crystals were strained with a device to maintain uniform shear stress on the glide planes. The law $\gamma = \gamma_0 + \beta t^{\frac{1}{3}} + \chi t$ (γ = total shear at time t, γ_0 = instantaneous shear accompanying loading, β, χ = constants) was obeyed closely [Abstr. 1669 (1910), 1779 (1914)].

539.501 3698
Rheological behaviour and classification. GARNER, F. H., AND NISSAN, A. H. *Nature, Lond.*, **160**, 329–30 (*Sept.* 6, 1947).—Results of viscosity measurements by two different methods of a petrol solution of Al stearate are reported, one of which classes the solution as "Newtonian" and the other as "non-Newtonian." It is proposed that classifications should be made by "regimes" rather than by the bodies themselves.

539.533 : 620.178.152.512 3699
Deformation of metals during single and repeated tensile impact. POPE, J. A. *J. Iron Steel Inst.*, **157**, 31–54 (*Sept.*, 1947).—[Abstr. 2915 B (1947)].

539.56 : 539.89 : 539.42 *see Abstr.* 3696

539.89 : 539.56 : 539.42 *see Abstr.* 3696

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

541.123 3700
On the number of independent constituents and the phase ule. PRIGOGINE, I., AND DEFAY, R. *J. Chem. Phys.*, **15**, 14–15 (*Aug.*, 1947).—Notes on Brinkley's article [Abstr. 435 (1947)].

541.123.5 : 533.15 : 539.155.2 *see Abstr.* 3613

541.123.59 : 539.155.2 3701
Isotopic nitrogen exchange between nitrogen pentoxide and dioxide. OGG, R. A., JR. *J. Chem. Phys.*, **15**, 613 (*Aug.*, 1947).

REACTION KINETICS 541.124/.128

541.126 3702
The initial stages of explosion in nitroglycerine. MULCAHY, M. F. R., AND VINES, R. G. *Proc. Roy. Soc. A*, **191**, 210–25 (*Nov.* 11, 1947).—The sequence of events which occurs in a thin confined film of nitroglycerine, after an explosion is initiated by a condenser spark, has been examined by means of a rotating drum camera. It has been found that in a very thin film (< 0·01 mm thick) the explosion begins as a gentle process which is propagated through the nitroglycerine film at 400 m/sec. After continuing for about 0·5 cm this process is transformed suddenly to a more violent type of explosion which is propagated at 2 000 m/sec. The explosion reproduces in miniature several of the well-known effects characteristic of the setting up of the detonation wave in gaseous mixtures. When explosion is initiated in the same manner in a thicker film, the 400 m/sec type of propagation is not set up immediately but is preceded by

a very much faster process ($< 5\,000$ m/sec), which after propagating for a few mm is transformed into the normal 400 m/sec process. Subsequent to this transformation the propagation continues exactly as in the very thin films. It is suggested that, under conditions of impact initiation, the propagation of the explosion through the film of nitroglycerine between the hammer and the anvil takes place in a manner closely similar to that which obtains after initiation by spark. A.

541.126 3703

The propagation of detonation in thin layers of nitroglycerine. MULCAHY, M. F. R., AND VINES, R. G. *Proc. Roy. Soc. A*, **191**, 226–42 (*Nov.* 11, 1947).—An investigation has been made on the propagation of the low-velocity detonation through layers of nitroglycerine 0·01 to 0·75 mm thick. By the rotating drum photographic method the detonation velocity was found to be $1\,800 \pm 200$ m/sec. The forward and backward movement of the decomposition products behind the detonation front has been recorded and the velocities measured approximately. Evidence has been collected which shows that the detonation does not proceed through the explosive as a uniform wave, but is essentially a discontinuous process involving a non-uniform distribution of intensity across the breadth of the detonation front. Supplementary evidence to that reported previously [Abstr. 1949 (1946), 3702 (1947)] is given of the analogy between the phenomena associated with the setting up of the low-velocity detonation in nitroglycerine and those characteristic of the initiation of detonation in gaseous systems. A.

541.126 3704

Properties of liquid explosives. VINES, R. G. *Nature, Lond.*, **160**, 400–1 (*Sept.* 20, 1947).—The behaviour previously reported for nitroglycerine [Abstr. 1949 (1946), 1336–7 (1947)] is found to be followed by several other explosives. Rotating-drum photographs show a slow first-stage and fast second-stage explosion wave, with a "retonation wave" spreading back to the point of initiation. Speeds of the various waves are reported for several explosives.

541.126 3705

Spread of detonation in high explosives. MITCHELL, D., AND PATERSON, S. *Nature, Lond.*, **160**, 438–9 (*Sept.* 27, 1947).—The propagation is uniform in other explosives than TNT [Abstr. 1662 (1947)] but may not necessarily be so even in TNT under different physical conditions. The calculation of speed of propagation from moving-film photographs is discussed.

ELECTROCHEMISTRY 541.13

541.132 : 534.321.9 *see Abstr.* 3449

541.133.1 : 539.155.2 = 3 *see Abstr.* 3616

541.135.5 3706

Mercury tube effect. BOCKRIS, J. O'M., AND PARSONS, R. *Nature, Lond.*, **160**, 232 (*Aug.* 16, 1947).—By anodic polarization of the dropping Hg electrode, the drops can be made to form at the end of an apparent tube or thread of Hg or Hg compound suspended from the capillary tube.

541.135.85 : 537.312.5 3707

The photovoltaic effect. The spectral sensitivities of cadmium, zinc and silver electrodes; the effect of *p*H and oxygen. BLOCHER, J. M., JR., AND GARRETT, A. B. *J. Amer. Chem. Soc.*, **69**, 1594–8 (*July*, 1947).—The spectral sensitivities of photovoltaic cells with Cd, Zn, and Ag electrodes have been measured and are discussed. With Ag photovoltaic cells neither hydrogen nor hydroxyl ions appear to be involved in the photovoltaic mechanism. But with halide solutions *p*H may determine the nature of surface exposed to radiation. The positive photovoltaic sensitivity of "pure" Ag electrodes in halide solutions arises from a layer of Ag halide on the electrode surface. Dissolved O_2 markedly affects photovoltaic behaviour and this indicates the need for more rigorous exclusion of O_2 in work with "pure" metal electrodes. W. R. A.

PHOTOCHEMISTRY 541.14

541.141 : 539.166.93 3708

Effect of gamma- and X-rays on dilute aqueous solutions of acrylonitrite. DAINTON, F. S. *Nature, Lond.*, **160**, 268–9 (*Aug.* 23, 1947).—The chain polymerization of acrylonitrite is known to be sensitized by the presence of neutral H atoms or hydroxyl radicals, but to be relatively unaffected by high concentrations of the ions. The results here reported indicate that the former are produced by photon irradiation of water [see Abstr. 296 (1945)].

ADSORPTION 541.183

541.183 = 5 3709

Velocity of spreading of surface monomolecular layers. LOVERA, G. *Nuovo Cim.*, **1**, 141–7 (*April*, 1943) *In Italian.*—A mathematical treatment and comparison of the results obtained by Marcelin, Joly [Abstr. 4824 (1938)] and by von Guttenberg [*Zeits. f. Phys.*, **118**, 22 (1941)] using the lycopodium method. Divergencies are explained by the differences in volatility of the substances used for the measurements; application of an appropriate correction produces good agreement between the experimental and calc. results. J. G.

541.183 : 539.16 : 778.3 3710

Adsorption isotherm of a photographic emulsion for uranyl and lead ions. BRODA, E. *Nature, Lond.*, **160**, 231–2 (*Aug.* 16, 1947).—[See Abstr. 1596 (1947)]. Further tests are reported, where concentration was varied more widely, and Pb ions also investigated. Uranium uptake is in excess of that possible by absorption alone, and the excess is attributed to adsorption; the isotherm has the form (wt. absorbed) = const. × (conc.)$^{0·8}$. The adsorption of Pb is measured by using solutions of the Pb isotope ThB mixed with inactive Pb to keep the radioactivity per unit vol. of the solution constant, and estimating the uptake by counting tracks of ThC or C′ α-rays.

541.183.35 = 4 3711

Surface potential of very dilute monomolecular films. GUASTALLA, J. *C.R. Acad. Sci., Paris*, **224**, 1498–9 (*May* 28, 1947) *In French.*—Surface potential is expressed as $V = 12\pi m(\delta - \kappa\delta^{3/2})$, ($m$ = vertical component of molecular moment, δ = surface density of film in Å^{-2}). This results in a change of sign of potential at great dilutions (gaseous films). Experiments with myristic acid films on distilled water were carried out at molecular areas of 1 000–30 000 Å^2 and good agreement with the above formula was obtained. Extrapolation to zero film density gives a value of $m = 1·8$ debyes for myristic acid. J. I.

541.183.5 3712

The relationship between the Brunauer–Emmett–Teller adsorption isotherm and the new isotherm of Jura and Harkins. LIVINGSTON, H. K. *J. Chem. Phys.*, **15**, 617–24 (*Sept.*, 1947).—Values for the surface pressure and area of molecules adsorbed on solid surfaces can be calculated

n the adsorption equation of Brunauer–Emmett–ler. Over a wide pressure range these calculated ues are in approximate agreement with the 2-dimen-nal equation of state for vapour-condensed films. ce the adsorption equation of Jura and Harkins bstr. 2715 (1943)] was derived from this same equation state, it is concluded that for a great many experi-ntal isotherms, the mathematical agreement between two adsorption equations is so good that extremely urate experimental work would be necessary to deter-ne which equation was more nearly correct. The nauer–Emmett–Teller equation gives calculated curves Gregg-type plots that agree qualitatively with those orted by Gregg [Abstr. 2812 (1943)] for multi-layer sorptions. Surface-area values obtained from these ves by Gregg's *X*-point method are generally con-erably higher than those that would be obtained by the thod of Brunauer–Emmett–Teller. The limiting area cupied by a molecule (i.e. in a mono-molecular layer) calculated by the method of Harkins and Jura appears decrease with decreasing energies of adsorption e. decreasing values of *c* in the Brunauer–Emmett–ller isotherm). It is suggested that this decrease is tificial, rather than real, and results from the assump-on that the constant *a* in the 2-dimensional equation of ate does not vary with changes in the nature of the lid adsorbent. A.

1.183.5 : 531.72 3713

Calculation of surface areas from measurements of gative adsorption. SCHOFIELD, R. K. *Nature, Lond.*, 0, 408–10 (*Sept.* 20, 1947).—An approx. formula for e negative adsorption of a charged surface in contact ith an electrolytic solution is given, in terms of con-ntration, valency ratio of ions, dielectric const. and rface charge. It consists of two terms, of which the rst depends on concentration, and the second on rface charge. The formula is successfully applied to entonite/Na salts measurements, and to measurements f adsorption of jute fibres.

41.183.56 3714

The adsorption of hydrogen on tungsten powders. ALSEY, G., AND TAYLOR, H. S. *J. Chem. Phys.*, **15**, 24–30 (*Sept.*, 1947).—An analysis of the extensive xperimental data of Frankenburg [Abstr. 1120 (1945)] as been made, using the Fowler–Guggenheim treat-ent of adsorption phenomena. It has not been found ossible to interpret the data in terms of interaction etween the adsorbed species on a uniform adsorbent rface; they can be interpreted on the basis of a non-niform surface without interaction, the heterogeneity f the surface being specified in terms of an exponential istribution of sites given by the distribution function $V = ce^{-\chi/\chi_m}$, where χ represents the energy difference etween the lowest energy state of the gas and the lowest nergy of the adsorption complex. Such a function yields he experimentally observed relation $d \log p/d \log \theta =$ onst. at const. temp. Such a heterogeneity is especially ignificant in the case of W metal which hitherto has been reated as an essentially uniform surface. The quantity χ_m has been found to vary with the temp. and the ignificance of this is briefly explored. A.

541.183.56 3715

The magnitude of the experimental error in the adsorption of nitrogen at 78°K on various surfaces. LOEBENSTEIN, W. V., AND DEITZ, V. R. *J. Chem. Phys.*, **15**, 687–8 (*Sept.*, 1947).

541.183.576 : 539.32 : 537.311.33 *see Abstr.* 3537

541.24 : 541.64 : 534.614 3716

Comments on "sound-velocity determination of molecular weights." DIENES, G. J. *J. Appl. Phys.*, **18**, 848–9 (*Sept.*, 1947).—Shows that the method for mol. wt determination of Abstr. 2297 (1947) does not necessitate sound-velocity measurements since mol. wts are easily calculable from molar refractions.

CHEMICAL STRUCTURE 541.4/.6

541.64 : 534.614 : 541.24 *see Abstr.* 3716

541.67 : 538.224 *see Abstr.* 3580

CHEMICAL PROCESSES 542.9

542.943 3717

The formation of hydrogen peroxide in the combustion of hydrogen at low pressures. EGERTON, A. C., AND MINKOFF, G. J. *Proc. Roy. Soc. A*, **191**, 145–68 (*Nov.* 11, 1947).

CHEMICAL ANALYSIS 543/545

545.82 = 4 3718

A new arrangement for quantitative spectral analysis. LOCHET, M. R. *J. Phys. Radium* (*Sér.* 8) **8**, 61–4 (*Feb.*, 1947) *In French.*—A number of specimens are excited simultaneously using series-connected electrodes. An optical device produces one spectrum for each source. Increases in accuracy and speed are claimed. H. H. HOP.

545.822/.3 : 535.33.072 3719

Direct-reading spectrometer for ferrous analysis. CARPENTER, R. O'B., DUBOIS, E., AND STERNER, J. *J. Opt. Soc. Amer.*, **37**, 707–13 (*Sept.*, 1947).—The direct-reading spectrometer [Abstr. 2297 (1946)] has been adapted for ferrous analysis. Data is given on reproducibility of analytical results obtained for Ni, Cr, Si, Mn, Cu, Mo, Al and Sn in steel. The inherent accuracy of the instrument is discussed with respect to both the electronic and photometric systems employed. Errors introduced are shown to be small compared with spectrochemical uncertainties inherent in the source. A.

545.827 : 539.155.2 3720

A mass spectroscope for analysis in the low mass range. SIRI, W. *Rev. Sci. Instrum.*, **18**, 540–45 (*Aug.*, 1947).—A simplified and portable design of the 180° deflection-type mass spectroscope was developed for quantitative analyses in the mass range from 4 to 65. The principal features include an oscillating accelerating voltage, permanent magnetic field, the use of a.c. amplifiers, and an oscilloscope. Successful application has been made to fixed gas, liquid and solid samples, and continuously flowing gases with changing component concentration. Accuracy from isotope ratio determinations $\simeq$ 2–5%. A.

CRYSTALLOGRAPHY 548

548.0 : 535.327 *see Abstr.* 3463–4

548.0 : 535.375.5 *see Abstr.* 3489

548.0 : 535.515 *see Abstr.* 3497

548.0 : 535.515.096 *see Abstr.* 3498

548.0 : 535.66 : 535.343.2 *see Abstr.* 3475

548.0 : 537.226.1 *see Abstr.* 3528

548.0 : 538.61 *see Abstr.* 3587

548.0 : 538.614 = 4 *see Abstr.* 3589–90

548.7 : 539.133 : 535.343.2–15 = 4 *see Abstr.* 3476

548.0 : 539.32 *see Abstr.* 3689

548.5 = 3 3721

On orientated growths of hexasubstitution benzene derivatives on [in]organic foundation lattices. WILLEMS, J., AND GILTGES, A. *Naturwiss.*, **33**, 345 (*Dec.* 15, 1946) *In German.*—Sublimed hexachlorobenzene and pentachlorotoluene deposit on the (110) face of ZnS with the (100) plane || to the face and the *b* axis along [110]. Hexa-ethylbenzene deposits on the (110) face of NaCl with the needle axis along [100]. A. J. C. W.

548.53 3722

Growth of "stimulated crystals" and rate of nucleation during recrystallization of aluminium. BURGERS, W. G. *Nature, Lond.*, **160**, 398–9 (*Sept.* 20, 1947).—The mechanism by which the growth of a crystal in fine-grained material can be initiated at a dormant nucleus when it is approached by a growing crystal is discussed. The author's earlier explanation [Abstr. 3320 (1947), 885 (1946)] is modified in the light of subsequent theories [Abstr. 2658–9 (1947)].

548.574 : 535.417 : 549.211 3723

Interference studies of diamond faces. A crossed fringe technique. TOLANSKY, S., AND WILCOCK, W. L. *Proc. Roy. Soc. A*, **191**, 182–94 (*Nov.* 11, 1947).—Precision multiple-beam interference methods are applied to the study of the topography of octahedral faces of three diamonds. A new crossed fringe technique of high sensitivity is described. Evidence is adduced to support the view that the curvature of diamond faces and the occurrence of triangular pits are to be attributed to growth and not to solution. The observations thus settle a long-standing controversy. Irregular depressions which are observed are attributed to a solution mechanism. New features associated with the triangular growth pits are described and interpreted. A crystal surface with regions showing an abnormally high degree of optical plane uniformity is described. The surface of a polished diamond is described. A.

548.7 3724

Dynamics of a square lattice. I. Frequency spectrum. MONTROLL, E. W. *J. Chem. Phys.*, **15**, 575–91 (*Aug.*, 1947).—Expressions for the distribution of frequencies of normal modes of vibration are obtained as a function of the force constants, using a Born–Karman model and neglecting all but nearest and next-nearest neighbour interactions. Only at low frequencies is the density of modes $\propto$ frequency; there exists two sharp infinities. A.

548.73 : 518.5 : 621.317.39 3725

An electronic computer for X-ray crystal structure analyses. PEPINSKY, R. *J. Appl. Phys.*, **18**, 601–4 (*July*, 1947).—[Abstr. 3036 B (1947)].

548.73 : 621.365.41 : 539.26 *see Abstr.* 3683

548.73 : 669.225.72 3726

An X-ray diffraction study of the silver-magnesium alloy system. LETNER, H. R., AND SIDHU, S. S. *J. Appl. Phys.*, **18**, 833–7 (*Sept.*, 1947).

548.74 = 3 3727

Determination of lattice constants by the electron microscope. KÖNIG, H. *Naturwiss.*, **33**, 343–4 (*Dec.* 15, 1946) *In German.*—Lattice constants are determined to an accuracy, in general, of $\pm 1\%$ and, in favourable cases, of $\pm \frac{1}{2}\%$ by a method involving the use of a standard specimen. The normal electron diffraction technique (with the Siemens microscope) is followed but the two specimens are placed side by side and from the relatively broad incident beam two narrow beams are selected by pinholes $\sim 0{\cdot}1$ mm dia. placed ~ 5 mm apart. One beam passes through the unknown and one through the standard, and the diffraction patterns are prevented from overlapping by a dividing screen which cuts off the inner half of each. An evaporated film of LiF is recommended as a standard since the possibility of contamination is much less than with metal films. J. T.

MINERALOGY 549

549.211 : 535.417 : 548.574 *see Abstr.* 3723

549.514.51 : 535.327 *see Abstr.* 3466

549.514.51 : 537.226.1 *see Abstr.* 3529

GEOPHYSICS 55

550.342 : 551.46 3728

Relations between sea waves and microseisms. DEACON, G. E. R. *Nature, Lond.*, **160**, 419–21 (*Sept.* 27, 1947).—A short review of available evidence is given. It has lately been discovered that microseism periods related to coastal swell are $\sim \frac{1}{2}$ the wave periods. The hypothesis is advanced that microseisms are caused by pressure on the sea bottom due to standing waves caused by interference of wave groups of the same period crossing in opposite directions; such standing waves can be expected where reflection occurs at a coast, or between waves generated in opposite quadrants of a cyclone.

550.342 : 551.515.1 3729

Microseisms and atmospheric oscillations. TILLOTSON, E. *Nature, Lond.*, **160**, 321–2 (*Sept.* 6, 1947).—A short review is given of investigations into the nature and origin of microseisms. They appear always to originate in areas of low barometric pressure at sea, and since 1943 storms in the Caribbean Sea have been tracked by seismographical observations made simultaneously from 3 stations (Florida, Cuba and Puerto Rico).

550.361 3730

Terrestrial heat flow in Persia. COSTER, H. P. *Mon. Not. R. Astr. Soc., Geophys. Suppl.*, **5** (*No.* 5) 131–45 (1947).—Variations in heat flow found in 18 bore-holes in SW. Persia are correlated with geological structure. The mean value of $0{\cdot}87 \times 10^{-6}$ cal/cm^2 sec agrees well with values in Britain and S. Africa. The influence of topography, tectonic movements and denudation on the heat flow is probably small, but climatic changes may have reduced it appreciably in the last 10 000 yr. A. HU.

551.46 : 550.342 *see Abstr.* 3728

551.461.2 : 525.66 3731

An investigation into the causes of the annual variation of mean sea-level in the North Sea. ALLISON, N. W. *Mon. Not. R. Astr. Soc., Geophys. Suppl.*, **5** (*No.* 5) 146–57 (1947).—Monthly mean sea-levels at North Sea ports show a Nov. max. and a May min. which are attributed to seasonal changes in the wind strength and in the water density. The magnitudes of these effects are calculated. The annual variation in the "calm" level is 8 cm in the N. half and 15 cm in the S. half. A. HU.

METEOROLOGY 551.5

06.2 = 3 3732

atospheric wave processes as causes of weather larities. FLOHN, H. *Experientia*, **3** (*No.* 8) 319–22) *In German.*—The existence of symmetries in the dar of singularities in the average annual weather and the fixation of the symmetry points in atmo- ic pressure within the calendar prove the causal ection between singularities and pressure waves. maximum of the amplitude of an important wave a period of 30·5 days) is situated in the atmospheric s above 20 km, that of waves with a period of 15 8) days in the altitude of the tropopause. The same s are found in the annual ozone trend. They extend the whole northern hemisphere. The length of these ective" pressure waves are single rational divisors e year. The singularities are to be understood as harmonic oscillations of the annual period, partly ed in the high stratosphere. A.

508.11 3733

simple nomogram for the rate of ascent of rubber ons and improved technique with balloons and balloon rial. MALURKAR, S. L. *Proc. Indian Acad. Sci. A*, 307–13 (*April*, 1947).—The usual formulae for the of ascent of rubber balloons filled with a lighter gas ain terms for the dead weight of the balloon and the lift of the inflated balloon. A simplified expression been derived. Gas-tight, moisture-proof jointing of phane can be effected by placing a thin strip of gutta- ha between overlapping cellophane edges and then ing a hot (~ 150°c) iron over the edge. W. R. A.

510.53 : 551.593.55 *see Abstr.* 3743

510.535 3734

n the evaluation of the parameter σ_0 in Chapman's ula for determining the ionic density of the E layer. GUPTA, M. M., AND DUTT, S. K. *Indian J. Phys.*, 1–6 (*Feb.*, 1947).—In a previous paper [Abstr. 2411 46)] it has been mentioned that the discrepancy of the retical values of ionic densities from experimental s for E layer is due mainly to the assumption of ng σ_0 constant during day and night. In the present er the authors give the values of σ_0 which seem to the best agreement possible. A.

.510.535 = 3 3735

tratification in the upper ionosphere. BURKARD, O. *Akad. Wiss. Wien*, **155**, *Abt. IIa* (*Nos* 5–6) 189–203 47) *In German.*—It is assumed that in the higher layers he ionosphere atomic oxygen (nitrogen) occurs which ionized by absorption of u.v. light from the sun. a fixed density distribution of the O atoms the intensity ionization is calculated with reference to the height the layer and the angle of incidence of the solar radia- n, assuming a flat earth's surface. It is shown that the endence on the angle of incidence no longer follows imple cosine law but the observations give a much ter agreement than for earlier theory. The new law olains how the ionization in the F_2 layer shows an portant increase before sunrise. Selected examples ow the failure of earlier theories and give a very good eement with observations for the F_2 layer. R. S. R.

.510.535 : 621.396.11 3736

The investigation and forecasting of ionospheric con- ions. APPLETON, E. *J. Instn Elect. Engrs, Pt IIIA*, (*No.* 11) 186–99 (1947).—[Abstr. 3161 B (1947)].

1.510.535 : 621.396.11 3737

The influence of wave-propagation on the planning of ort-wave communication. TREMELLEN, K. W., AND COX, J. W. *J. Instn Elect. Engrs, Pt IIIA*, **94** (*No.* 11) 200–19 (1947).—[Abstr. 3162 B (1947)].

551.510.535 : 621.396.11 = 4 3738

The propagation of radio waves and ionospheric predic- tions. HAUBERT, A. *Ann. Télécommun.*, **1**, 251–7 (*Nov.*, 1946) *In French.*—[Abstr. 3163 B (1947)].

551.515.1 : 550.342 *see Abstr.* 3729

551.521.1.081.4 : 53.081.4 3739

Unit for solar radiation work. *Nature, Lond.*, **160**, 327 (*Sept.* 6, 1947).—The *langley* is proposed (abbrev. "ly") defined as one 15°c gm.cal. per cm². Radiation can then be expressed in "langleys/min," etc.

551.576.11 = 4 3740

The law of distribution of drop sizes in clouds. BRUN, E., AND DEMON, L. *C.R. Acad. Sci., Paris*, **224**, 1373 (*May* 12, 1947) *In French.*—1946 observations were unusual since the number of drops increased as their diameters decreased. W. A. R.

551.576.11 = 4 3741

Measurement of diameters of drops in a cloud. BRUN, E., DEMON, L., AND VASSEUR, M. *C.R. Acad. Sci., Paris*, **224**, 1518 (*May* 28, 1947) *In French.*

551.593.55 : 535.43 3742

On the rôle of secondary scattering of light in twilight phenomena. YUDALEVIČ, T. *C.R. Acad. Sci. URSS*, **55** (*No.* 8) 709–12 (1947).—The theories of Fessenkow and Staude gave a means of obtaining the distribution of density and temp. from photometric twilight studies over the range 30–40 to 100–150 kms, but Hulburt showed secondary scattering limited the range. A more rigorous theory has been applied, allowing for this, which permits numerical calculation to be performed simply and with considerable accuracy to obtain quantitative estimates of the share of secondary scattering in the total sky bright- ness at different twilight moments. R. S. R.

551.593.55 : 551.510.53 3743

The effect of changes in twilight colour on the study of upper strata of the atmosphere by the twilight method. MIGRELISHVILI, T. G. *C.R. Acad. Sci. URSS*, **55** (*No.* 8) 705–8 (1947).—Comparisons of photometric measure- ments of the twilight sky may show differences due to differences of spectral sensitivity of the photometer used, visual, photographic plate and photoelectric cells. Staude's results have been used for a comparison of photographic and visual methods and show differences up to 36% in brightness and of 15–100% for the effective height of scattering strata with zenithal range of 94° to 100·5°. R. S. R.

551.594 3744

Discharge currents associated with kite balloons. DAVIS, R., AND STANDRING, W. G. *Proc. Roy. Soc. A*, **191**, 304–22 (*Nov.* 18, 1947).—Observations of electric currents flowing in the flying cables of barrage balloons were made during an investigation of the problem of protecting balloons in thundery weather. It was found that charges of the order of coulombs are transferred between balloon cable and air by currents ranging from milliamperes to kiloamperes. The observations give some indications of the distribution of charges in clouds. A.

551.594.22 3745

Photographic study of lightning. HAGENGUTH, J. H. *Trans. Amer. Inst. Elect. Engrs* (*Prepr.* 47–98) 19 *pp.*— Seven years' observations in a special lightning laboratory at Pittsfield are discussed. In addition to medium-speed and high-speed Boys' cameras a special camera with 12 lenses covering the whole horizon and a stereoscopic camera are used. Statistical results are presented and

compared with previously published data of the following parameters: number of strokes in multiple flashes, duration of flashes, time intervals and persistence of illumination between component strokes, and amplitudes of current peaks. It is believed that almost all normal flashes show downward branching. Occasionally two earth termini are observed and these may occur either simultaneously or successively as a result of a change of path between successive strokes. Indications of short upward streamers from earth are detected. In a few cases the velocities of leader strokes could be determined and leaders were also observed in some cloud-cloud flashes. Active cloud heights are found to vary mostly between 2 000 and 7 000 ft although heights of 16 000 ft have been noted. The stroke density and the number of storm days is discussed. Lightning phenomena in Pittsfield are shown to be of the same character as in other parts of the world. R. H. G.

551.594.221 3746

Occurrence of upward streamers in lightning discharges. GOLDE, R. H. *Nature, Lond.*, **160**, 395–6 (*Sept.* 20, 1947).—It is believed that streamers may be produced at some instant during the leader process of the discharge which rise from the earth to meet the leader. Calculations have been made of the height of the tip of the leader when this process might be expected to start, and the results given on a graph in terms of the current in the discharge. Three such reported occurrences are c cussed (one is illustrated) and it is shown that they in rough agreement with the theoretical calculations.

551.594.221 : 621.316.98 = 5 37

Lightning. REBORA, G. *Elettrotecnica*, **27**, 254– (*June* 10, 1940) *In Italian.*—[Abstr. 3013 B (1947)].

551.594.5 : 621.396.9 37

Radio echoes from the Aurora Borealis. LOVEL A. C. B., CLEGG, J. A., AND ELLYETT, C. D. *Natu Lond.*, **160**, 372 (*Sept.* 13, 1947).—Radio echoes from distance of 480 miles were obtained on 46 Mc/s, apparen arising from a luminescent cloud near the end of an aurc streamer. There was also general non-localized reflecti from the same region on 46 and 72 Mc/s. The ionizati density is estimated to have been ~100× the avera *F*-layer night ionization.

551.594.6 : 523.854 : 523.72 *see Abstr.* 3411

551.594.6 : 621.396.11 = 4 37

Normal and guided propagation of an atmospheric in t atmosphere. HAUBERT, A. *Ann. Télécommun.*, **1**, 185–2 (*Aug.–Sept.*, 1946) *In French.*—[Abstr. 3164 B (1947)].

551.594.6 : 621.396.11 : 621.317.34.087 = 4 37

Statistical recording of atmospherics and field-streng recording for radio transmitters. CARBENAY, F. *A Télécommun.*, **1**, 117–35 (*July*, 1946) *In French.*—[Abs 3027 B (1947)].

BIOLOGY 57/59

577.088.75 : 538.569.2.047 = 4 3751

Effect of 21 cm h.f. radiation on the temperature of small laboratory animals. DE SÉGUIN, L., AND CASTELAIN, G. *C.R. Acad. Sci., Paris*, **224**, 1662–3 (*June* 9, 1947) *In French.*—A hundred rats and mice were exposed to a 1 400 Mc/s field (10–200 W), and temp. changes, injurious and lethal effects observed. Temperature regulation is inhibited, and death is due to excessive temperatures. E. E. C.

577.088.75 : 538.569.2.047 = 4 3752

Reversibility of injuries in small animals exposed to ultra-high frequency waves (21 cm). DE SÉGUIN, L. *C.R. Acad. Sci., Paris*, **225**, 76–7 (*July* 7, 1947) *In French.*—When rats and mice were exposed to 21 cm waves for short periods, only reversible effects were observed providing the temperature of the animal was not raised above 41°c. In some cases thermo-regulation was inhibited. E. E. C.

578.088.5 : 539.16 = 4 3753

Apparatus and method of measuring radioactive biological preparations. JOYET, G. *Helv. Phys. Acta*, **20** (*No.* 3) 247–9 (1947) *In French.*—An apparatus for the determination of the radioactivity of the ashes of tissues is described, using a Geiger tube containing alcohol and argon. A. J. M.

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.845 3754

On the influence of accommodation on spherical aberration in the human eye, an attempt to interpret night myopia. IVANOFF, A. *J. Opt. Soc. Amer.*, **37**, 730–1 (*Sept.*, 1947).—See Abstr. 2738 (1947).

612.855 3755

A theory as to the function of the scala tympani in hearing. DE ROSA, L. A. *J. Acoust. Soc. Amer.*, **19**, 623–8 (*July*, 1947).—The scala tympani canal is assumed to be coupled to the scala vestibuli of the cochlea throughout its length. If the mathematics are formulated for th premise, with appropriate boundary conditions, it found that despite the absence of reflections and standi wave patterns, there is, nevertheless, an area of ma stimulation of the basilar membrane as a function frequency. Interpretation of various acoustical phen mena is simplified by reference to this analysis.

612.858.71 37

A pulse-tone technique for clinical audiometric thresh measurements. GARDNER, M. B. *J. Acoust. Soc. Ame* **19**, 592–9 (*July*, 1947).

612.858.71 37

Auditory thresholds of short tones as a function repetition rates. GARNER, W. R. *J. Acoust. Soc. Ame* **19**, 600–8 (*July*, 1947).—Auditory thresholds we obtained for repeated short tones (sine-wave) wi repetition rates between ¼ and 100 per sec, and to durations between 1 and 50 msec. Both noise-mask and quiet thresholds were measured. Although the tot energy in a stimulus can be changed by varying eith the repetition rate or the duration, the results show th only in the latter case is there an equivalent shift in t threshold. Discussion of the results in terms of spectr distribution of energy of such tones leads to the co clusion that the ear does not perform a Fourier analy of these tones. Further discussion indicates the co ditions necessary for temporal integration of acoust energy by the ear.

612.858.71 = 393 37

The relation between masking, perception of tone pit and loudness. MOL, H. *PTT-Bedrijf*, **1** (*No.* 1) 24 (1947) *In Dutch.*—The perception of a sound is general hindered by the presence of another sound. It is e plained how the sensation of pitch of a pure tone m be suppressed by the presence of a different pure ton and how the total loudness of a mixture of two pu tones may be < the sum of the loudnesses of the separa components.

3759 58.71 : 534.756

ie growth of auditory sensation. MUNSON, W. A. *coust. Soc. Amer.*, **19**, 584–91 (*July*, 1947).—The ration of sensation with respect to time was studied rimentally by means of tones of short duration. dness tests were made on sounds persisting from 5 to 0·2 sec and covering a wide range of levels. observed increase in magnitude of a sensation as the tion time is increased is attributed to the integration acteristic of the central nervous system, and an valent electrical circuit is derived. The circuit ogy is then used in the computation of loudness as a tion of the duration of the stimulus. A.

3760 858.71 : 534.76 = 5

he threshold displacement in bi-auricular audition. E, A., LO SURDO, A., AND ZANOTELLI, G. *Ric. Sci. ostruz.*, **17**, 32–9 (*Jan.*, 1947) *In Italian.*—In order to y the mechanism by which an observer is able to te a source of sound, and to determine the min. erence in phase or in rel. intensity of sound perceived the two ears necessary for detecting a displacement direction) of the source, an electronic beat frequency illator was designed, capable of generating pure tones all audio-frequencies, at varying phase and const. nsity, const. phase and varying intensity, or varying se and intensity. Two tones of equal frequency, but variable intensity and phase, are conveyed to the two s separately. At 256 c/s, an intensity ratio of 0·8–0·9 s just perceptible by the observers at 45–70 db; a se difference of 5°–8° was perceptible at the same quency and amplitude. Apparatus is described in ail and results are discussed. J. A. W.

3761 2.858.71 : 534.83

Sensitivity to changes in the intensity of white noise and relation to masking and loudness. MILLER, G. A. *J. oust. Soc. Amer.*, **19**, 609–19 (*July*, 1947).—Sensitivity to changes in the intensity of a random noise was determined over a wide range of intensities. The just detectable increment in the intensity of the noise is of the same order of magnitude as the just detectable increment in the intensity of pure tones. For intensities >30 db above the threshold of hearing for noise the size in db of the increment which can be heard 50% of the time is approx. constant (0·41 db). When the results of the experiment are regarded as measures of the masking of a noise by the noise itself, it can be shown that functions which describe intensity discrimination also describe the masking by white noise of pure tones and of speech. It is argued, therefore, that the determination of differential sensitivity to intensity is a special case of the more general masking experiment. The loudness of the noise was also determined, and just noticeable differences are shown to be unequal in subjective magnitude. A just noticeable difference at a low intensity produces a much smaller change in the apparent loudness than does a just noticeable difference at a high intensity. A.

3762 614.72 : 539.16

Tolerance concentrations of radioactive substances. MORGAN, K. Z. *J. Phys. Coll. Phys.*, **51**, 984–1003 (*July*, 1947).—A review of some of the equations and procedures involved in determining the max. permissible concentrations of radioactive bodies when taken into the human system. Long- and short-lived radioactive elements, and chain reactions, rate of fixing in or elimination from the body, are discussed, and some sample problems worked out.

614.898.5 : 621–784.3 : 537.531 *see Abstr.* 3552

3763 615.84 : 621.395.645.3

Electro-encephalograph amplifier. JOHNSTON, D. L. *Wireless Engr*, **24**, 231–42 (*Aug.*); 271–7 (*Sept.*); 292–7 (*Oct.*, 1947).—[Abstr. 3153 B (1947)].

.02 : 533.5 *see Abstr.* 3439

GLASS . CERAMICS 666

66 : 532.13 : 539.2 *see Abstr.* 3681

66 : 539.2 *see Abstr.* 3680

66 : 539.389.3 *see Abstr.* 3694

666 : 539.4.011.25 : 539.389.3 *see Abstr.* 3695

666.22 : 535.327 *see Abstr.* 3465

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669.225.72 : 548.73 *see Abstr.* 3726

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7.011 : 537.312.5 *see Abstr.* 3539

71.534.53 : 535.247.1 = 3 *see Abstr.* 3460

78.3 : 539.16 : 541.183 *see Abstr.* 3710

3764 78.33 : 535.371.07

Characteristics of X-ray films and screens. MORGAN, . H. *Radiology*, **49**, 90–4 (*July*, 1947).—Data on haracteristics of commercial X-ray films and fluorescent creens published by the U.S. Public Health Service. Detail is definitely greater with unscreened films by ~ 5 : 1, even with the best screens manufactured. Contrast is shown to be dependent upon the emulsion, vith preference to the yellow-sensitive emulsion, as ompared to the blue. Persistence of the screen luorescence also varies with the spectral sensitivity in favour of the yellow sensitive emulsion, and this becomes of importance in the use of roll film rapid exposures and may affect the performance of automatic photo-electric timers. A recently produced screen and film combination is mentioned. B. J. L.

3765 778.344 : 535.214–15 = 4

Two new methods for infra-red photography. I–II. HEINTZ, E. *J. Phys. Radium* (*Sér.* 8) **7**, 293–9 (*Oct.*); 336–41 (*Nov.*, 1946) *In French.*—Continuing earlier work [see Abstr. 2428 (1946)] Part I gives full details of the experimental technique involved in obtaining infra-red photographs by turbulence in selected liquids. Part II described further work on the deformation of liquid surfaces produced by infra-red radiation. A. H.

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see "Note on the arrangement of Abstracts"
links subjects dealt with independently in the article
indicates extension over several numbers (e.g. 535.41/.43 represents 535.41 to 535.43 inclusive)
signifies Language (e.g. = 3, in German)
signifies Place (e.g. (485), in Sweden)
is used to attach special analytical subdivisions applicable to certain sections (e.g. –31, ultra-violet; 535.34–31, ultra-violet absorption)
indicates other analytical subdivisions applicable throughout Sections 53/59 (e.g. .08, measurement; 536.63.08, measurement of specific heat)
Numbers are normally divided into groups of three figures by stops for convenience

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